THE

ELECTRICAL REVIEW.

VOL. LV. JULY 8, 1904. No. 1,389.

ELECTRICAL REVIEW.

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THE

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TRAMWAY RUNNING POWERS.

IN our issue of May 6th, 1904, we had occasion to rejoice at the decision of a Parliamentary Committee giving the Tyneside Tramways Co. compulsory running powers from their present terminus at Wallsend to the Central Station in Newcastle. But the cordon which shields the property of the municipal trader has, for the moment, proved too strong, and Parliament has, by a majority of 36 votes, sent back the Bill in question to the Committee. The latter sat again on Wednesday this week, and an account of its deliberations appear on another page of this issue.

We have searched the report of the discussion in the House in vain for any valid reason why these running powers should be refused. Let us look at the arguments used by Sir J. Woodhouse, who moved the House of Commons to reverse the decision of its own Committee—a decision based, of course, not upon the private opinions of the members of that Committee, but upon the evidence of witnesses from the locality. He said:—

> I have sought in vain in the evidence for any public demand other than that of some 56 manufacturers who are concerned in the Tyneside industries on the east of Newcastle, and it is not denied that a number of these manufacturers are shareholders in the Tyneside Co.

In other words he insinuates that, so far from there being any public need for the running powers, they were sought simply and solely for the purpose of putting money into the pockets of shareholders. As it seems to us, this contention is completely overruled by the argument of Sir E. Strachey, the chairman of the Committee which reported the Bill in question to the House. He said:—

> The question which we had to consider was whether it would be convenient to the working men going to their work and returning to their homes, that there should be a system of through cars from one centre to another. It has been said that we had evidence from the trade unions against the Bill. That is quite true; but we also had evidence from working men—whether they were members of trades unions or not I do not care—who maintain that it would be a great convenience to them if these running powers were granted.

Hearing such evidence, and weighing it in the balance with that which had been put forward on the other side, the Committee made its report. In the circumstances it is extraordinary that Parliament should have adopted the unusual expedient of referring the matter back.

Everyone who has any knowledge of the district in question appears to recognise that there is a strong case for through communication. We cannot recall any other district which could put forward such a strong claim for through communication, and it is impossible to explain the opposition of Parliament except upon the hypothesis that our legislators were reluctant to create a precedent. The alleged absence of precedent was relied upon by Sir J. Woodhouse when he said:—

> As the spokesman of a unanimous meeting of representatives of the municipalities, I ask the House to send back the Bill for reconsideration. I deny that there is any precedent for compulsory powers being given to a private company over a municipal tramway system, except under special circumstances which do not serve as a precedent for any particular case.

In our view, if it be true that there is no precedent (which we do not admit) it is high time that Parliament should make one. In the case under notice, the company were not asking to run their trams for nothing; the terms upon which the running powers were to be granted were to be settled by the Board of Trade. Further, the very fact that in other districts, companies and local authorities have made agreements for mutual running powers, is a justification for the grant of compulsory powers, if there is any evidence that the travelling public will be thereby convenienced.

At a time when electric tramways bid fair to assist in solving some of the problems connected with the housing of the working classes, it is deplorable in the extreme that Parliament should not only refuse to encourage the principle of running powers, but, by the recommittal of the Bill in question, should have created a precedent which must assuredly fetter the discretion of Private Bill Committees in the future.

The Public Authorities' Protection Act.

THE case of Lyles *v.* the Southend Corporation, a report of which appeared in our issue of June 24th, decides a question of considerable importance to corporations and other local authorities who work the electric trams in their district. It appears that the plaintiff, who had been travelling on the roof of an electric car, brought an action to recover damages for injury sustained owing to the bar flying out of place. The Corporation, by their defence, pleaded that they had not been guilty of any negligence, and, in the alternative, that they were protected by the Public Authorities' Protection Act, 1893, which provides that an action brought against a local authority for any act or omission in the course of their public duty, must be launched within six months of the accident or injury complained of. In this case the plaintiff was admittedly out of time; but it was urged that, inasmuch as the defendants had simply been guilty of a breach of contract to carry the plaintiff carefully, the accident was not due to "an act or omission" within the meaning of the Public Authorities' Protection Act. Mr. Justice Bigham has now held that the point whether the act complained of amounted to a breach of contract was immaterial; in his view it was sufficient that it had occurred while the defendants were performing their statutory duty in carrying the plaintiff. As it seems to us, this case involves rather an important extension of the principle which gives local authorities a certain immunity from actions at law. Although the matter is not one of certainty in the minds of lawyers, negligence in the conveyance of passengers may well be regarded as a breach of contract. It is arguable, therefore, that hereafter every action for breach of contract against a local authority should be commenced within six months of the date of the breach. In order to avoid the risk of a non-suit on any such ground, any person who has a claim against a corporation for breach of contract will do well to enforce it promptly.

Falling Telegraph Wires.

IN our issue of January 29th, 1904, our legal contributor dealt at some length with the legal questions which are likely to arise if live trolley wires break and fall upon liege subjects who are making lawful use of the highway. In a case which was recently decided by a deputy judge sitting at the Brompton County Court, the question of liability for the breakage of a telegraph wire came up for discussion. We refer to Brown *v.* South-Western Railway Co., in which the plaintiff sought to recover damages for injuries sustained by her owing to the fall of a telegraph wire while she was passing over Putney Bridge. It appeared that the wire in question had been put up and was maintained by the defendant company, together with their own wires on their own poles. The wire, however, was the property of the Postmaster-General, and was used exclusively by the General Post Office. The railway company were under agreement with the Postmaster-General for the maintenance of the wire. It appeared that the accident was caused by the wire giving way where it had been soldered. Two contentions were put forward on behalf of the defendants, namely, (*a*) that they had not been guilty of any negligence causing the accident; (*b*) that they were excused from liability owing to the fact that the wires were the property of the Crown, that they were acting as agents for the Crown, and could not, therefore, be *tort feasors* in that capacity. This contention was, of course, based upon the principle that "the King can do no wrong."

The learned judge held that there was evidence of negligence to go to the jury, and the plaintiff was awarded £15 damages. The second question is one of considerable interest and importance. Undoubtedly, if the action had been brought against the Postmaster-General, he could have sheltered himself behind the immunity of the Crown. It seems, however, that if a person injured by a falling telegraph wire can find the person who put the wire up he is at liberty to sue him, although the wire may belong to the Crown and be used in the public service. In giving judgement on this part of the case the judge said:—

It is true that the Crown, or a servant or agent of the Crown, acting officially for the Crown, can only be reached whether in *tort* or contract by a petition of right; but, if the workmen of a Government department who are charged with negligence can be found, they are liable to be sued. So, too, an agent of the Crown, who commits a trespass, can be sued individually, though not in his official capacity. Again, in the case of contractors to a public department, if the damage is the inevitable result of the execution of a public work under statutory authority, an action against the contractors would fail; but, if the damage arises from the negligent execution of the work, and might have been avoided by the exercise of proper skill and care, the contractors will be personally answerable for the damage done.

That this is an accurate statement of the law appears from the case of Graham and Others *v.* His Majesty's Commissioners of Public Works and Buildings ((1901), 2 K. B., 781). It was there decided that an action will lie against His Majesty's Commissioners of Public Works and Buildings who are incorporated by statute for damages for breach of contract entered into by them with a firm of builders for the erection of a public building. It was so held by Ridley, J., because the Commissioners must be taken to have made the contract specially themselves, and not as agents of the Crown, and by Phillimore, J., because the Commissioners are in the position of servants of the Crown, who may be sued on their contracts for the purpose of obtaining a judgement declaratory of the right of the subject who has contracted with them.

In the case of Rayleigh *v.* Goschen ((1898), 1 Ch. 73), it was decided that the head of a Government Department is not liable for wrongful acts of officials in the department, unless it can be shown that the act complained of was substantially the act of the head of the department himself. The plaintiffs commenced an action against the Lords of the Admiralty with the object of establishing as against them that they were not entitled to enter upon or acquire by way of compulsory purchase certain land, the property of the plaintiffs, for the purpose of erecting thereon a training college for naval cadets, and claiming damages for alleged trespass, and an injunction to restrain further trespass. It was decided that though the plaintiffs could sue any of the defendants individually for trespasses committed or threatened by them, they could not sue them as an official body, and that as the action was a claim against the defendants in their official capacity, it was misconceived and would not lie; leave to amend by suing the defendants in their individual capacity, and by adding as defendants the persons who had actually trespassed on the land was also refused, and the action was dismissed with costs. The declaration that the proprietors of a telegraph wire may be held liable for injuries is of indirect interest to electric tramway companies who use the trolley system. Although they are bound by statute or provisional order to erect guard wires, telephone or telegraph wires do occasionally fall upon live conductors. In that case the danger is greatly increased. In the article above referred to we said that:—

Where trolley wires are uninsulated, and there is no guard wire above them, the breaking of a telephone wire sometimes short-circuits the trolley main. The result is, that serious injury is caused by electric shock. In these circumstances it appears, upon the authority of a County Court judge, that responsibility does not rest with the tramway company. In Bedworth & Son *v.* The National Telephone Co., an action was brought against the company for the price of a horse killed by an electric shock. It appeared that a broken telegraph wire, which fell on the horse, had short-circuited a trolley wire belonging to the South Staffordshire Tramway Co., who were joined as defendants. The judge held that the telephone company were liable, as they had been guilty of a trespass in allowing their wire to touch that of the tramway company, and he made them responsible in damages.

The principle applied by the County Court judge in the case of a telephone wire now seems to be of equal force in the case of a telegraph wire.

SIMPLE STORIES.

By "INNOCENS."

IV.—Municipal Trading.

My friend Warlock Jones, the world-renowned and yet most modest detector of hidden things, sat on the mat in his sanctum, smoking his bulldog pipe—type of tenacity and inconceivable British Pluck.

"You seem to forget, my dear Jobson," remarked he, "that the position in which I have placed myself is that usually adopted by the Hebrew Jew (who is distinguished for his subtlety and power of hair-splitting discrimination), and, moreover, by the Sultan of Turkey, who has achieved the distinction of being publicly referred to as Abdul the Damned. . . . Pray don't interrupt! I know that you are going to ask me how I divined your thoughts concerning my posture, in order that you may write an alluring opening paragraph for our next adventure. The explanation is perfectly obvious—so simple that only you and the British Detective Force could miss it. I sat here on purpose. If I'd sat on a chair, you would have noticed nothing. As I sat on the floor, you spotted it at once, and thought how clever it was of me to think of it."

The amazing perspicacity of these remarks so confounded me that I became oblivious to outward things until I noticed an indefinable change in the detective's face—a look which reminded me of the expression on an Irish terrier when it thinks it has found a rat. At the same instant I heard the far-off rattle of wheels, which rapidly grew louder, till, with a slur of horses' hoofs and the crash of a prematurely-opened cab-door, a vehicle came to a standstill immediately beneath our window, and the door-bell was violently pealed.

I glanced at Warlock Jones. Not the slightest trace of emotion was visible. He remained on the mat, posing for all he was worth.

The door was flung open without ceremony, and a man, evidently recently respectable, but now in a state of perspiring collapse, stumbled in.

"For Heaven's sake, are you Warlock Jones?" he exclaimed piteously to me.

"No, no!" I answered, hastily, "I'm only his friend, Jobson. You'll see the detective on the mat, if you'll go round the table.

"The amazing ignorance of the average person!" exclaimed Warlock Jones. "Now, anyone with a grain of sense would have seen for himself that Jobson was only my advertising agent. . . . Well, sir, I see that you missed the connection at Birmingham."

"Why—why, sir!" stammered the newcomer, "how do you know?"

"Ah, yes, yes! It is quite simple. Read that!" The detective drew a piece of newspaper from his waistcoat pocket and flung it on to the table. Read it out loud, or else Jobson can't write it up properly."

"'The Editor, *Assington Guardian*,'" began the visitor.

"Yes, yes!" he continued eagerly, "it is the same!"

"Read on!" replied Warlock Jones, imperturbably.

"'Sir,—Is it a fact that, after borrowing £28,000, and getting together a *large* staff of *expensive* officials, to say nothing of a special committee, who take *free* trips all over the country—is it a fact, Sir, that the Borough of Assington is to be burdened with a *financial loss* of several hundred pounds on the second year's working of its electric light scheme? If so, sir, I beg to protest most emphatically as a *ratepayer* and *voter* against the imbecile extravagance of our *so-called* councillors. Yours indignantly, Candles' . . . Yes," said the visitor, handing back the paper with a shudder. "You have guessed it!"

"Not guessed, but reasoned it," corrected the detective indulgently. "I saw the cutting. I knew your difficulty. I foresaw your line of action. I looked up the train you would take. I reckoned you would miss it. I waited for you. I even got my friend Jobson here to take notes for his next advert—story—and here you are!"

"Then you know all," sighed the gentleman. "There is no need for me to explain—"

"Oh, by all means explain!" interrupted Jones hastily. "The record would be unintelligible if the problem were not stated. Take notes, Jobson, please."

"Your name and occupation, sir," I began.

"Name, Burgess; occupation, chairman of the Lighting Committee,—grocer in my spare time."

"Thanks. Will you state your case?"

"Two years ago, sir, we started our unrivalled electric light system—a scheme to which I referred in my speech at the Town Hall as the most epoch-making event in the history of Assington—one that would bring along the millennium, if not more. And now, sir,"—the speaker's voice sank to a whisper—"the second financial year is up, and—we can't find the profit! There *ought* to be a profit, oughtn't there, sir?"—turning despairingly to Warlock Jones.

"Undoubtedly — undoubtedly!" he replied, briskly. "There *always* is a second-year profit in municipal ventures. You must have lost it somewhere."

"No efforts have been spared to find it," replied Burgess, despondingly. "The Borough Accountant has added up all the figures himself, and checked the vouchers. He even added up the figures backwards to see if he couldn't find the profit that way."

"And he couldn't," smilingly anticipated Jones. "Naturally. Mere local muddlers can't. Come, Jobson, this case promises to be interesting. Put your hat on and we will catch the next train."

"Do, sir, by all means!" ejaculated Burgess. "Our Borough Engineer is partially insane over it. He is obsessed by two words—'Bermondsey Clause'—which he repeats continually; he even raves about raising the price per unit, and we fear he will have to accompany the Institution of Electrical Engineers to America to recover his tone."

"The matter is indeed urgent," said Jones. "Come, Jobson, we have no time to lose."

The arc lamps of Assington were burning brilliantly, but as we drove up to the generating station I was conscious of a foreboding of disaster. The presentiment was only too true, for as we entered the Engineer's office a fearful sight arrested us. Papers were strewn over the desks and chairs; and on the floor, under the glare of the electric light, lay the insensible form of the Borough Engineer.

"Great Heavens, he has swooned!" exclaimed Burgess, "Bring brandy and water, quick!"

"No, no!" interjected Warlock Jones, "Don't you see the station cost sheets on the desk? He has received a species of electric shock. Apply the Sylvester treatment at once!"

For half an hour we laboured, according to the methods prescribed by the Electrical Review Shock Sheet, until, with a sigh, the engineer resumed consciousness.

"Is the profit found yet!" he gasped.

"Alas, no!" replied the chairman, "but—here is Warlock Jones!"

"Now," said the great detective when the first transports were over, "Let us carefully examine the known facts. First, there *must* be a profit in existence somewhere, as otherwise the scheme would be the only one which has not received awestruck commendation from the municipal journals on its second anniversary. Secondly, the profits are not at present palpable—eh? Well, we will find them. Have you a refuse destructor? Yes?—Good! A refuse destructor attached to a central station, consumes power, usually electrical, in handling the refuse. Have you charged the Sanitary Committee with power consumed, at, say, 2d. a unit? No? Dear me! Well, that gives us an additional revenue of —? Two hundred pounds. Thanks."

"Have you considered the fact that public electric lighting is the greatest anti-criminal agency of modern times? In other words, have you rented all your public arc lights to the Watch Committee at £10 18s. 4d. each per annum?—Heavens, no?—By doing so, you obtain an increased revenue of £567 13s. 4d. Good!

"How are we now? Still three-fifty out? Ah, well, let me look at the General Statement."

As Warlock Jones glanced at the sheet, he gave a start of surprise—a most unusual thing, for the detective generally displayed the utmost *sangfroid*.

"Great heavens! what is this?"

We all gazed anxiously at the sheet. In addition to

"sinking fund" and "balance charged against local rates," was displayed the legend "*depreciation of plant.*"

"My dear sirs!" expostulated Warlock Jones. "My very dear sirs! How can you expect a profit after a cruel blow like this? Surely you must know that a plant is, if anything, in slightly better order after two years' run than when it started! £500 for depreciation? Awful! Terrible! We will write down a *minus* quantity for that at once, say, £—50, which gives us five-fifty to put against that three-fifty, and so——"

The chairman and the engineer sprang up simultaneously, and clasped each other in a wild embrace, shouting: "*The profit is found!*" Then, turning to Warlock Jones, they wrung his hands in speechless admiration.

"Nonsense! nonsense, my dear sirs! A most ordinary matter!" said the great detective, with smiling deprecation. "It is done all over the country."

THE COLLIERY EXHIBITION.

(*Continued from page* 6.)

Coal-cutters (continued).—Messrs. John Davis & Son exhibited two Jeffrey's chain headers, one of the electric, and one of the air-driven type suitable for thin seams. In the electrically-driven machine the motor was of 18-h.p., shunt wound, geared down through cut bevel gear to the chain shaft. The motor is fixed with this gearing on a movable frame, which is moved forward on the under-frame by rack and pinion gearing. The stationary frame is provided with two stays fitted with handwheels, the one in front being fixed against the coal, and set at an angle so as to prevent the cutters running across the coal face, and so slewing the machine out of line. The one at the back of the machine is fixed against the roof, thus securing the under-frame firmly in its proper position to guide the cut. These stays are shown in position in fig. 1. The forward feed is at the rate of about 6 ft. in 3½ minutes, the return stroke being done in about ½ minute. The rate of feed depends upon the material being cut, and may be set to half the rate given above if necessary. The machines are built for under-cutting to a depth of 5, 6, or 7 ft. with a width of 44 in. These headers are made in two types, the high and low type, and are used for pillar and stall work, and for driving headings and narrow places. The usual time occupied in under-cutting a heading 11 ft. wide, including moving the machine into position and out again for shot firing, is about 45 minutes. Two shot holes can be drilled simultaneously by means of the Jeffrey drill, as the men have usually time to do this while the machine is under-cutting. The dimensions of the high type machine are: height, 29½ in.; length, 10 ft. 3 in.; width, 3 ft. 2 in.; weight, 29 cwt.; and of the low type the weight is 27 cwt., and the height 18½ in., the length and width remaining the same as in the high type.

Our illustration (fig. 1) shows an electric header of this type starting to cut. The motor is here shown in the back position, and it will gradually move forward as the cut advances until it is at the forward end of the machine.

The air power header is similar in design to the above, but there is, of course, less reduction of speed between the motor and the chain. The overall dimensions are: length, 10 ft. 8 in.; width, 3 ft. 3½ in.; weight, 27 cwts.; and height, 21 in. The speed of cutting is about the same as with the electrical machine, and the working pressure is 40 lbs. per sq. in.

In addition to the above, a longwall coal-cutter was shown, equipped with a 30-h.p. motor, designed to undercut 4 ft. 6 in. at floor level. A feature of this machine is that it is of the mono-rail type, which permits of the machine being tilted so as to cut at an angle. The disk is fitted with straight cutters which, of course, minimise smithing work. There appears to be a lot of gearing about the machine, the power being transmitted through both spur and bevel gearing before it reaches the disk; the gears, however, are of steel, and are machine cut and run in oil. A special feature

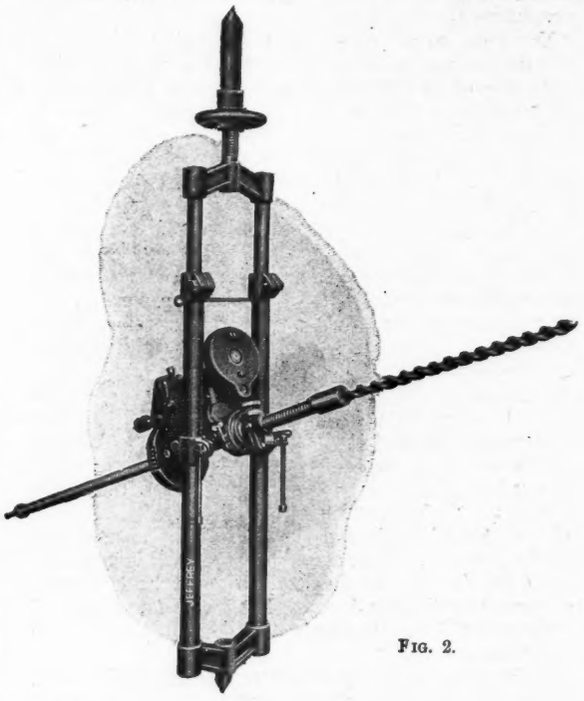


Fig. 2.

of the machine is that the rate of feed can be adjusted by means of ratchet and pawl mechanism, the ratchet being set to take different numbers of teeth so as to give three different rates of feed.

The electric drill referred to above is shown in the second illustration (fig. 2). These are made in frames of different lengths to suit various seams, and the handwheel

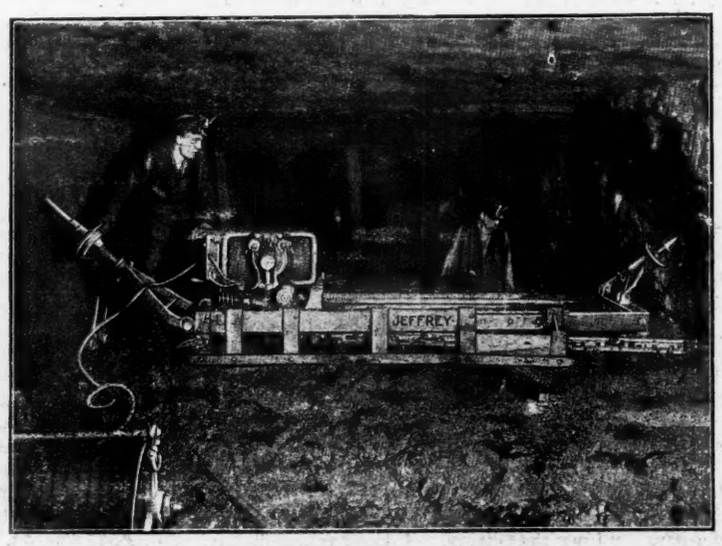


Fig. 1.

and screw at the top allow of a variation of 8 in. in the height. The motor is geared down to the wheel by two sets of spur gearing, one at the back and one at the front of the motor. It is series wound, and is mounted on trunnion brackets, which are arranged to slide up and down the sides

of the frame, so that the height of the drill can be adjusted and the angle can be varied by more than 90°. The drill and frame complete weigh about 180 lbs. When cutting, the thrust is taken up by a ball race on the front of the machine, and a slip clutch is provided which allows of slipping if the drill should meet with any serious obstruction.

Drilling in coal, a hole 2 in. in diameter and 6 ft. deep can be finished in about 2½ minutes, including the changing of drills. Extension pieces are provided, by means of which exploration holes can be bored to a depth of 21 ft. A 2-in. hole of this depth can be bored in about 55 minutes.

At the same stand were shown a portable single drum haulage gear, a portable air compressor, together with junction boxes, patent starting switches, &c., which are referred to elsewhere under a different section.

Messrs E. Scott & Mountain, who were very early in the field of electric lighting and power in collieries, had a most interesting exhibit embracing three-phase and continuous-current generators, motors, pumps, switches and coal-cutter. The latter is of quite a new design, the result of many years of experience, and embodies many interesting features. It is a disk type of machine adapted for long-wall work, and can be fitted with motors from 25 to 40 H.P., depending upon the class of work for which the machine is intended. The overall dimensions of the machine are 8 ft. 6 in. long by 3 ft. 3 in. in width, and a height from the rail level of 1 ft. 2 in. The overall height with skids is 1 ft. 8 in., or with rails 1 ft. 10 in. The machines can be arranged to undercut to 3 ft. 6 in., 4 ft. 6 in., or 5 ft. 6 in.

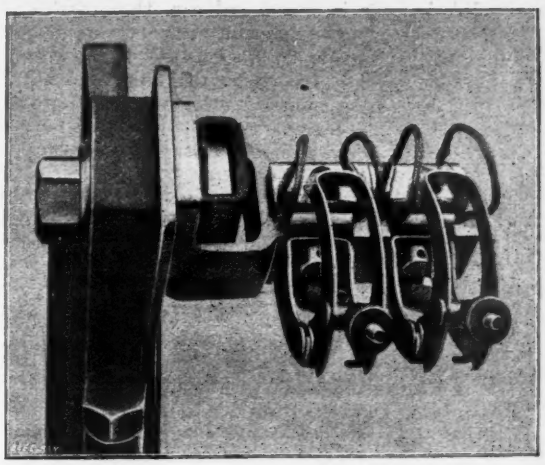


Fig 6.

bevel wheel on a short vertical shaft, which, at its lower end, carries another bevel wheel gearing with a pinion fixed on the shaft driving the disk. The upward pressure on the vertical shaft is taken by a ball thrust bearing, and the whole of the gearing, which is machine cut, is enclosed and runs

Fig. 3.

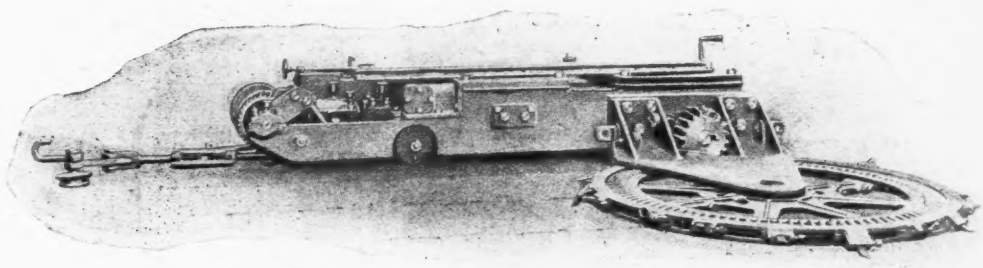


Fig. 4.

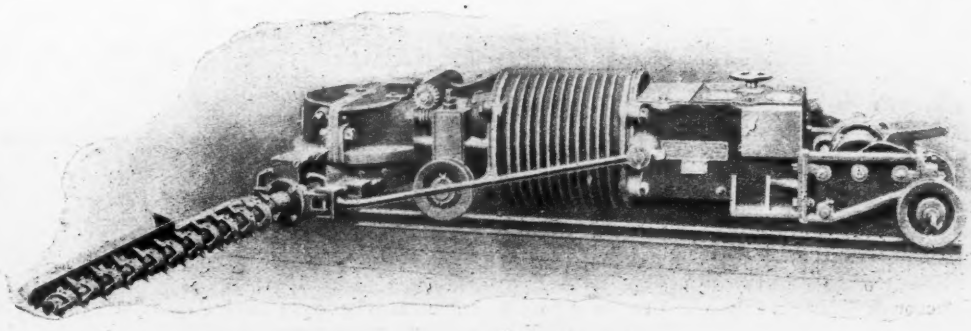
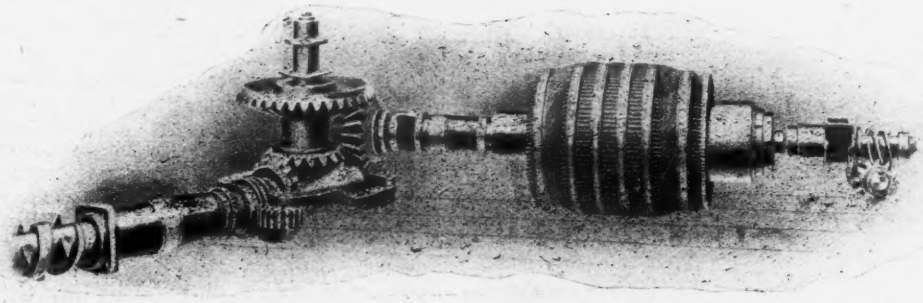


Fig. 5.



The notion that anything is good enough for colliery work is certainly not shared by Scott & Mountain, as the details of this machine are worked out very carefully, and the gear between the motor and the disk is of the very highest class. The motor shaft is provided with a pinion, gearing into a practically in an oil bath. The bearings are all lined with white metal and are of extra length. That in the centre of the cutter disk is of the roller type, and is lubricated by means of a grease cup, and a brass pipe fixed to the centre of the machine.

The disk is made in halves, and can, therefore, be re-removed without interfering with the centre bearing. The illustration on p. 45, fig. 3, shows the compact nature of this machine. The cutters on the disk are straight, as in the Jeffrey machines. The feed is operated by means of a worm and worm wheel mounted on an extension of the motor shaft. This is also enclosed and runs in oil. As this new type of machine has not been extensively used yet, it is too early to obtain data as to its actual performance so far as the power consumed and rate of cutting on longwall work are concerned; but there is no doubt that it will compare favourably with any other machines of this type on the market. To run the machine light requires only 1¼ E.H.P. when new.

Among other apparatus exhibited by this firm, were starting and reversing switches, an electrically-driven compressor, referred to later under this heading, and valve boxes for three-throw pumps. Messrs. Scott & Mountain make a speciality of mining pumps, particularly pumps for high lifts up to heads of 1,800 ft.

Another very interesting electrically-driven disk type of cutter was shown at the stand of Messrs. Clarke, Steavenson & Co. This also is a new design, superseding the earlier type in which the disk was driven through bevel gearing. The gearing is here reduced to the simplest form, in that the disk shaft is driven from an electric motor through a single reduction worm gear, consisting of a steel worm and phosphor-bronze worm wheel running in oil, the end thrust being taken up in a ball thrust bearing of substantial design. It is claimed by the makers that this machine effects a reduction of energy amounting to about 35 per cent., and that it is practically silent in running, so silent, in fact, that conversation can be carried on near the machine whilst cutting. It is difficult to see how a single-threaded worm transmitting 25 H.P. can be so very much more economical than bevel spur gearing, or how 35 per cent. of the power can be saved, seeing that the power required to run a machine so driven, is only 1¼ E.H.P. when running light. The power required for actually cutting the coal is not affected by the method of gearing, so the only economy that can be effected is in driving the machine. The vibration of the machine is also said to be considerably reduced due to this method of driving; this would tend to reduce materially the wear and tear of the moving parts. This machine is designed to undercut 5 ft. 4 in.

A compressed air machine is also shown for longwall work, designed for 3 ft. 6 in. undercut. The latter is adapted for cutting seams at a minimum height of 20 in., and the power required is 23 H.P. No figures are yet available for the new type of machine, and it will be interesting to learn whether the expectations are realised by results in actual working.

Turning now to an entirely different type of machine—namely, the bar-cutting type, the only representative of this type was the "Pickquick" machine, exhibited by Messrs. Mavor & Coulson. Three machines were exhibited, driven respectively by continuous and three-phase electric motors and by compressed air. The latter is a somewhat cumbersome-looking machine, and will not compare very favourably in dimensions with some of the other machines shown. As regards the electrical machines, however, some interesting data are available. From the illustration given on p. 45 (fig. 4) it will be seen that the cutter itself consists of a taper bar upon which a spiral thread is cut. Between the threads, holes with feather ways for the cutter shanks are drilled, into which the cutters are driven. As the bar revolves, the spiral thread acts as a conveyor, bringing the cuttings out from the holing. When cutting in wet clay it would appear that the conveyor might easily choke up and drag. The inner end of the bar is provided with a special oscillating bearing, and by means of gearing a reciprocating motion is imparted to the bar, which further helps to bring away the cuttings from the holing. The bar is geared to the motor through a nest of bevel gearing, very similar to that in the Scott & Mountain disk machine, but there is only one reduction of speed, viz., from 900 to 450, two of the bevel wheels being of the same size. A view of the gearing is shown on p. 45 (fig. 5). The gearing is enclosed in a gear-box, the lower part of which is capable of being slewed in any direction from one side of the machine to the other through an angle of more than 180°. The whole of the gear head can also be turned round its horizontal axis, thus permitting the cutter bar to be elevated or depressed, or turned in a half-circle from one side of the machine to the other. These movements, therefore, permit of the cutter bar being placed at practically

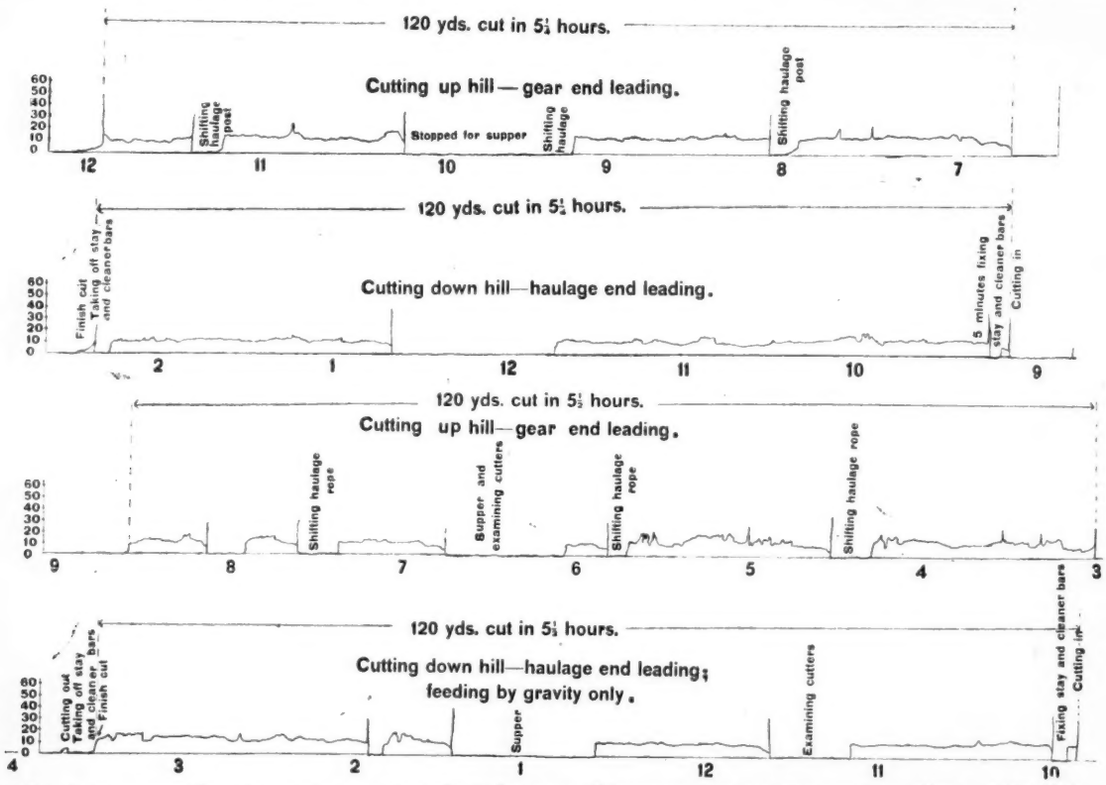

120 yds. cut in 5¼ hours.
Cutting up hill—gear end leading.
Shifting haulage post
Stopped for supper
Shifting haulage
Shifting haulage post
120 yds. cut in 5¼ hours.
Cutting down hill—haulage end leading.
Finish cut
Taking off stay and cleaner bars
5 minutes fixing stay and cleaner bars
Cutting in
120 yds. cut in 5½ hours.
Cutting up hill—gear end leading.
Shifting haulage rope
Supper and examining cutters
Shifting haulage rope
Shifting haulage rope
120 yds. cut in 5¼ hours.
Cutting down hill—haulage end leading; feeding by gravity only.
Cutting out
Taking off stay and cleaner bars
Finish cut
Supper
Examining cutters
Fixing stay and cleaner bars
Cutting in

Fig. 6.—Pickquick Bar Coal-Cutter at Law No. 2 Colliery; Recording Ammeter Charts, April 11th to 14th, 1904. Pressure, 480 Volts at Switchboard.

any angle on any side of the machine, but when on one side, the bar is, of course, at the bottom, and, on the other, at the top of the gear casing, giving a difference in the height of the bar of about 8 in. The electric motors are, in both cases, entirely enclosed, the continuous current machine being of the four-pole shunt-wound type, with slotted drum armature. The brushes possess some points of novelty, being made from steel stampings, and having an adjustable tension screw, and also a very definite hold-off position (see fig. 6). As regards the alternating current motor, this is the only machine exhibited which is driven by a squirrel-cage motor—that is, without any slip-rings. There are no soldered or riveted connections in the rotor, the bars being short-circuited by means of a copper ring cast direct on them. An auto-starter contained in an enclosed cast-iron box is fixed alongside the motor, and, by means of this, the motor is started up without any resistance coils or sliding contacts.

The following dimensions and weights of these machines may be compared with others of the disk or chain type. A machine driven by a continuous current motor, and suitable for undercutting 4 ft. 6 in., has the following overall dimensions :—The extreme length is 9 ft, 3 in.; width, 3 ft. 4 in.; height, 1 ft. 6 in.; minimum head room required, 2 ft.; weight, 32 cwt., plus 2½ cwt. for the cutter bar. Power of motor, 23 H.P. The three-phase machine is 2 in. longer, 2 in. narrower, and 4 in. higher, the weight being 37 cwt., or 5 cwt. more than is required for the continuous-current machine. As to the power required for this type of machine, it is claimed by the makers to take less power than is required for any other coal-cutter on the market, the saving being in the proportion of 25 to 17. It is claimed, also, that the coal is rounder, and the waste less than with any other machine. Some very careful tests of the actual working of these machines have been taken, from which it is clear how uniform is the power absorbed. Fig. 6 is a copy of a recording ammeter chart, taken at the Law No. 2 Colliery, which illustrates this point.

At the Law Junction Colliery the average figures for five months' regular working are 120 to 130 yds. per nine hours' shift bank to bank. A copy of the Record Card for December, 1903, was given in the "Correspondence" columns of our issue for Feb. 26th, 1904, from which it is seen that 120 yds. were cut per shift, undercutting 3 ft. 9 in. The expression "power used per ton output" in this table is obviously a mistake for "energy." The chart herewith, fig. 6, shows the time taken by each shift to cut 120 yds., and it will be noticed that the current never rose above 20 amperes except momentarily.

(To be continued.)

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week.

The Conductometer.

I should have preferred to add nothing to my criticism on the above instrument, which appeared in the ELECTRICAL REVIEW of March 29th and May 6th, and only do so now in order to reply to certain points to which Mr. Appleyard directs my attention in his article published in the ELECTRICAL REVIEW of May 13th and 20th, and June 3rd, and asks for a reply.

I had better explain that I have been abroad for the last four months, and that the REVIEW for June 3rd only reached me three days before leaving Brazil for England, otherwise I should have replied sooner.

The first point raised by Mr. A.—if, for brevity, he will kindly allow me to refer to him thus—is :—

"It must be by some mischance that he ignores the cardinal fact that the conductometer lends itself with complete facility to measurements of percentage conductivity by the mass method"—*see* May 13th, p. 809.

I am not aware that, in Mr. A.'s original description of his instrument which I criticised, any reference was made to a *mass* method. Possibly there may be some incidental remark which I am not in a position now to look up; but how it is a *cardinal* fact, or why I should refer to it, or indeed, the relevance of the quotation, I am at a loss to see. Perhaps Mr. A. has in his mind the communication made to the Physical Society, to which he refers in the ELECTRICAL REVIEW of June 3rd; or in the *Philosophical Magazine* for March this year. If so, I did not have the good fortune to be present at the one or to see a copy of the other, because I left England on March 4th. Besides, I had better point out the fact—which, of course, Mr. A. could not know—that my criticism referred to was sent to the ELECTRICAL REVIEW in October of last year, shortly after his description appeared, but that, owing to a plethora of good things on hand, it had to be pigeon-holed for six months before it was published. It has, therefore, become to me ancient history.

I notice, in Mr. A.'s more recent article, that he now sometimes speaks of *weights* as well as diameters, and has thought it desirable to turn his attention to what he calls a *mass* method; but my criticism dealt only with his original method, in which he relied on *diameters* only.

Mr. A. says (June 3rd, p. 902) :—"By whatever instruments we measure electrical conductivity, the result obtained by the *diameter* method will not agree with the result obtained by the *mass* method, except within limits depending upon differences of density of the specimens."

I do not propose, just now at any rate, to deal with this refinement, especially as the subject is rather an involved one, but only with the conductometer as proposed to be used for testing hanks of copper wire required for cable conductors; and since the purity per cent. of the finished conductor is in practice determined by its resistance per naut, or statute mile, at a given temperature, without reference to *density*, such a consideration, though interesting, is not of immediate practical utility. Moreover, I wish to confine myself to answering Mr. A.'s questions, lest the length of this article may necessitate its being dovecotted, as was the case with my first criticism.

Mr. A. says, May 13th, p. 809, that my criticism "erroneously suggests that the conductometer requires the diameter to be measured *before* testing, and if done only *immediately* prior to balancing, as is said to be the practice, gauging delays the process of testing. The truth is that the conductometer puts no restriction whatever upon the operator as to the particular stage of the testing at which the wires are to be either weighed or gauged. . . . The operator may use this mechanical device at any time he pleases, either before or after the electrical balancing."

In reply to the above, I think I had better let Mr. A. show in the following sentences that this is not only what he himself explained in his original description, but what he still says on the same page, viz., "In view, however, of the labour involved in repeatedly turning over and handling several tons of copper wire, it is often convenient, and always economical, to complete the gauging and the electrical balancing at a single handling. With the conductometer the whole operation of gauging, electrical balancing and labelling a hank with its mean diameter, and with its measured percentage conductivity, takes on the average *less than half a minute*.

Again on p. 817, May 20th, Mr. A. says :—"The figures, however, indicate that gangings should be taken while the wires are on the testing bench." . . . "If the gauging is left for subsequent measurement, this would almost certainly involve additional time and labour, and the fact of winding up and unwinding the hank, and straightening a length sufficiently for gauging might induce error."

Where, then, is my erroneous suggestion in saying that the conductometer requires the diameter to be measured *before* testing, and if done only *immediately* prior to balancing, as is said to be the practice, gauging delays the process of testing; when, in Mr. A.'s own words, "stranders are calling out for wire" (and) "there is little leisure; and, moreover, any such postponement of the report from the testing-bench retards the flow of work through the shop, and fills up the floor space with unpassed stacks of wire."

At such high pressure as Mr. A. thus graphically describes "when the whole operation of gauging, electrical balancing, and labelling a hank with its mean diameter, and with its measured percentage conductivity, takes on an average *less than half a minute*," I don't think my criticism is inappropriate where it says :—"This method is open to the

objection that gauging, although doubtless correct in *principle*, may be incorrect in *practice*, especially if the diameter of the wire be very small. In that case a slight error in gauging makes a serious difference in the weight deduced from it." "No doubt exceedingly careful gauging can give a close approximation to the relative weights when the zeros of the gauges are frequently checked; ratchet springs press with equal force on the wire; several readings are recorded, and the true mean obtained from them; and above all when a strict supervision is exercised over gaugers, who (to save time) are prone to become less careful; and inaccurate gauging naturally entails incorrect results."

Mr. A. has pointed out that "wire as received from the wire drawers may vary in diameter to the extent of 0·5 to 1 per cent. in a length of a few yards."

This emphasises how uncertain diameters are, and what a large number should be noted from which to obtain a true mean.

Mr. A. says—May 20th, p. 816—"30 ft. of copper wire of about 44 mils diameter, was gauged in 64 places by an observer (A.), and in 66 places by an observer (B.)."

"Difference of A.'s and B.'s average gaugings = 0·085. The chances are, therefore," he concludes, "that even with careful gauging of copper wire we are likely to make an error of about 0·1 mil."

But a very small tithe only of the above gaugings could be devoted to each hank, since "the whole operation of gauging, electrical balancing and labelling a hank with its mean diameter, and its measured percentage conductivity, takes on an average *less than half a minute*."

The gist of my criticism is that when supplying wire in a factory for cable conductors, gauging would be too hurried to give a reliable mean; and that too much is left to the gauger. For laboratory experiments, where there is ample time to gauge accurately, closer results can, no doubt, be obtained, but in that case why not trust to the more reliable *weight* method? Mr. A. says—May 13th, p. 810—"The conductometer is put forward not as an instrument for the extreme refinements of laboratories, but as a commercial instrument adequately fulfilling all the requirements of practical routine work."

In my criticism I further pointed out that the conductometer, after all, only attempts to give the conductivity per cent. as compared with pure copper; whereas when supplying wire for a specification, weight is as important as purity per cent. An error, therefore, in gauging not only affects the measured purity per cent., but the weight also. In short, the method depends too much on the gauger; and to note sufficient gaugings and to mean them out takes too long.

Mr. A. further says, May 13th, p. 809:—"It must be by inadvertence that, for the purposes of his article, he annexes the scale of my conductometer, inserting it in his diagram 2, p. 727, as his scale B; and that he discourses about the combination 'as a simple metre bridge .... without any alterations or additions.'" Mr. A. adds:—"In defence of my instrument, I am therefore obliged to state that the particular graduation of that scale B is described for the first time in my patent .... and that it is an essential and characteristic feature of the invention."

I had better explain that diagram 2, in which the percentages B occur at the head of the columns, represents a printed sheet of paper, and that the instrument for measuring is nothing more than "a simple metre bridge .... without any alterations or additions," with the ordinary mm. scale. That these percentages (B), moreover, do not represent *actual*, but *resultant*, conductivities depending both on purity and weight, and corresponding to the particular mm. readings (C) below them as read from the metre bridge scale when balance is obtained. That they are not essential to the system I described, but are added to the printed form to show that it is possible to arrive at the same result as with the conductometer by merely subtracting from, or adding to, the *resultant* per cent. B the correction per cent. as shown by the gauged diameters, if the latter be resorted to as the index of relative weights.

Mr. A. is, no doubt, fully entitled to his patent, because it is an instrument which does—more or less correctly, depending on the accuracy of gauging the wire—what no other instrument, so far as I know, has been designed to do; but he can scarcely claim that, because he uses a similar graduation (with more sub-divisions) on one of the *adjustable* scales of his instrument, no one else may calculate the number of mm. divisions corresponding to percentages (and their intermediate quarters) with a view to printing those percentages also on the test sheet. If this were so, it follows that much less may one have them engraved on a scale, even though it be a *fixed* one, as a substitute for the mm. scale of the ordinary metre bridge, to measure even *resultant* conductivities per cent., and not *actual* conductivities per cent., as the conductometer does. Even supposing the latter contention were admissible, Mr. A.'s fears are groundless, as the metre bridge used by me has only the mm. scale.

On p. 810, May 13th, Mr. A. says:—"In describing a method which he says has been in use 'for many years,' Mr. John Rymer-Jones informs us that 'the standard is given a resistance equivalent to a wire of 100 per cent. purity, and of the *exact specified weight*, by adjusting its length to something more or less than 30 ft. as required.' I should be glad to know how many years this method of adjustment of the standard to 100 per cent. has been in use, the plan adopted for measuring the revised length of wire, the time taken to complete a test by that system, and the degree of precision attained."

I shall be pleased to answer these questions, but their relevancy is not very apparent; for even if the system which I have employed successfully for many years were not as perfect as it might be, that would not make the results of the conductometer—depending as they do on hurriedly gauged diameter—any more reliable.

I am not offering to the public an alternative instrument, nor am I presuming to recommend my system to other wire testers, who very probably have already a better and more expeditious method. I merely refer to one satisfactory system which requires only the ordinary metre-bridge.

A simple way of obtaining a standard resistance of 100 per cent. purity, and of the exact specified weight, is as follows:—

If one of the 10 per cent. lengths tested and weighed have a calculated purity of (say) 101 per cent., mark off by an ink line (after allowing a definite length for clamping) 30 ft. plus 1 per cent.; and if its weight in grains per 30 ft. be 1 per cent. above that specified, increase the length again by 1 per cent., *i.e.*, give the standard wire a length of 30 ft. + 2 per cent., or 30 ft. 7·2 in. If, on the other hand, the weight and purity per cent. are of opposite sign, adjust the length according to their difference per cent.

Speaking of his own standard wire, Mr. A. says on p. 815, May 20th, "It is quite practicable to use resistance coils, or wires of the exact resistance values, or resistance coils corrected by shunts, to correspond to 100 per cent. for the particular diameter of wire under test. But with the conductometer, &c., &c."

My objection to the above is that *coils*, even though made of copper wire, would not be suitable, because they would not be subjected to the same change in resistance as a long bare wire under test, exposed as it is to the changeable temperature of a factory room (due to sun, wind, or hot pipes, &c.) during a few hours. So that, unless the standard and tested wires are exposed to the same changes of temperature, results will not be so correct, nor will early hanks compare well with those tested later on. Mr. A. himself warns us to "remember that the error is about 0·23 per cent. per 1° F. difference of temperature between the wires." (See p. 902, June 3rd.)

My having introduced the percentage heading B on the printed paper form (Diagram 2) has evidently led Mr. A. to conclude that a percentage scale is necessary and that the results are reduced to percentages. This, however, is not the case, as the usual mm. divisions below them, in heading C, are sufficient for the purposes of the system. As I have already explained, the presence of the percentages B on the test sheet is essential only for showing [see Electrical Review, April 29th, p. 727] that the correction per cent. for weight—if hand gauged diameters be relied on as an equivalent—is merely a matter of subtraction from, or addition to, the *resultant* conductivity per cent. (*i.e.*, depending on both weight and purity) as shown by heading B above the mm. reading at which the balance is obtained. This

resultant value a "simple metre bridge . . . without alterations or additions," can measure by employing a suitably adjusted standard wire against which to balance the wire under test. By this method, moreover, hanks can be gauged when most convenient, so that testing can proceed uninterruptedly. I do not, however, think this method of measuring the purity per cent. satisfactory, because hurriedly gauged diameters introduce serious errors.

In describing my system, I preferred also to refer to the upper heading B instead of to the equivalent metre scale reading C below it, because when using a standard wire of 100 per cent. purity and of the exact specified weight, the limits of the maximum and minimum resultant resistance of hanks admissible are more readily seen at a glance by these percentages than by the mm. readings. This is, however, not very important, because any given percentage has a definite position among the mm. readings (C), and, after being calculated once for all, for any gauge of wire tested by this method, that particular column can be marked, and the same holds for the opposite extreme limit. There is, moreover, another slight advantage, when using this exact wire standard, in placing the percentages (B) above the mm. readings (C) on the printed sheet. For instance:—As the purity of wire supplied by the best makers is often remarkably regular—and whether this is so, and how much the average differs from the standard will be evident from the 10 per cent. of hanks tested separately for purity per cent.—the resultant percentages B (whether *actual* or only *approximate*) will show at a glance whether the differences in grains at the head of the different columns will approximately account for the differences in their respective resultant percentages. If not accounted for entirely by difference in weight, it will be partly due to a difference in purity. The percentages (B) have no special advantage over the mm. readings (C) except that they, perhaps, make more evident at a glance the full meaning of the data brought together on the test sheet. Either serve equally for classifying. They do not determine the supply of wire to meet a specification. This is decided by the weights per 30 ft. in grains, and the properly measured purity of 10 per cent. of the hanks, both of which are noted at the heads of the respective columns in which these hanks are classified when the electrical gauging is completed. This is really the basis of the system, besides which there are other safeguards referred to in my description in the Electrical Review of May 6th.

Using a wire of 100 per cent. purity, and of the exact specified weight, has the advantage that the classified values of any unused hanks, will occupy the same columns on a similar sheet without re-testing when another order has to be executed to the same specification. Wire of 100 per cent. (Matthiessen's standard) has about the average purity commonly supplied for high conductivity copper.

As stated, however, on p. 733, May 6th, "It will be evident that, instead of making the resistance of the standard equal to that of a wire of 100 per cent. purity, and of the exact weight specified, a 30-ft. length may be cut from *any* of the hanks, and all the other hanks electrically gauged and classified in relation to each other by comparison with it."

In practice it is sufficient to select as a standard, from the 10 per cent. tested for purity, a hank of *approximately* 100 per cent. purity, and the weight required, without stopping to adjust its length with any greater exactitude.

This system was first used by me about 20 years ago (I don't happen to have any memo. as to the exact date with me), and since then nine or ten different persons have successfully worked it for some 16 or 17 years.

As hand-gauging does not enter into the test, the electrical gauging—including both weight and purity—is carried on uninterruptedly, *i.e.*, as fast as 30 ft. of each hank can be uncoiled, clamped, the balance obtained, and the next coil substituted. Actual balancing takes only a few seconds.

Mr. A. complains that my criticism is calculated to be detrimental to the reception of the instrument.

I feel sure that if that were possible the high encomium which you have been induced to accord it in your leader of June 3rd, will prove a powerful offset against any objection which I have advanced against trusting to hurriedly gauged diameters on the testing floor of a factory. Practical wire testers are well able to judge its capabilities on its merits, and my criticism, which was only published after an interval of six months, can scarcely be said to *prejudice* them against it; nor does it contain anything more than a fair comment on an instrument offered for an important branch of cable construction, in which I have long been interested.

J. Rymer-Jones.

P.S.N.C. steamer *Panama*,
June 27th, 1904.

Hadfield's Self-Aligning Trolley Head.

In reading the description given in your paper of the 1st inst., of Mr. Hadfield's self-aligning trolley head, there is one thing I should like to know concerning same, and that is whether, and if so how, it would be affected in the case where the trolley wire runs at a distance from the car, as is the case in one or two routes in this district, as it appears to me that the man in charge would have considerable difficulty in getting the wire into the groove of the wheel, when changing from one wire to the other at a journey's end, owing to its always being in line with the pole when in the off position, and not free to swivel round except when in the on position.

H. N. B.

Birmingham.

[The same point was raised by us when the inventor first showed us a sample of his trolley head; he pointed out that the wheel was allowed a certain amount of play, being free to rotate through a horizontal angle of, say, 10° on either side of the mid-position, and this, together with the splay of the groove, facilitates replacement on the wire. But as the pole very rarely has to swing out to an angle greater than 45°, we think the difficulty is more apparent than real.—Eds. E.R.]

The Life of Tram Rails.

Mr. Charles Hall's letter on "The Life of Tram Rails," which appeared in the issue of the *Electrical Times* on May 26th last, shows that on this most important factor of tramway finance, very little precise information exists.

A similar paucity of solid fact is observable in almost every department of tramway practice, and the small amount of knowledge which has been culled from experience, is possessed by tramway managers, and seldom, if ever, by consulting engineers who advise committees and companies; it is not surprising, therefore, that the first flush of pride which follows the opening of a municipal tramway is often followed by a period of despondency, sometimes of despair.

The "repairs account" of an electrical tramway is a very serious item in the working cost, and it behoves every committee, therefore, to ascertain beforehand as nearly as possible, what provision they will have to make to keep their plant in first-class working order—I say "first class," because it is cheaper than any other class.

It is my lot in life to run the Devonport tramways, than which, I believe, there is nothing more stiff in the United Kingdom. The road is all up and down, and it is difficult to decide whether the up grades or the down grades are the more expensive. One thing I do know, which is, that our accidents have all occurred in descending. *Facilis descensus Averno* sounds very sweet, but when *Avernus* takes the form of a court of law, the English translation thereof, viz., "the bottomless pit," expresses the idea so accurately that even a shareholder could understand it.

My hobby is "wheels and brakes," and they occupy my working hours, and when I dream it is usually of brakes that won't grip, and of gigantic wheels that mistake me for a rail. I ease my mind in daylight by collecting statistics. I find that our chilled cast-iron wheels weigh, when new, 315 lbs., and when they retire to the scrap heap, their weight is reduced to 266 lbs. Net loss per wheel 49 lbs., or 196 lbs. per car. This result is attained after an average mileage of 35,000 miles, which gives an average of 5·6 lbs. of wheels per 1,000 miles.

In the same time (which is about 12 months) the brake blocks are renewed 18 times, they weigh when new 112 lbs. per set, and their scrap weight is 68 lbs., the total weight of brake blocks ground down is, therefore, 792 lbs., or wheels

and brake blocks together equal 28·2 lbs. of metal per 1,000 miles. The track-brakes are made of wood, and are renewed every day, their morning weight is 10 lbs., and their evening weight is 6 lbs. We therefore grind up in 12 months 2,920 lbs. of wood per car.

This is not all—just as we use oil to reduce friction in the bearings, we apply sand to make the wheels grip the rail. In 12 months one car uses 20 tons of sand. We admire "grit" in a man, but grit on the track is entirely destructive, though it is just as much necessary as it is evil—it holds up the car and it holds down the dividend. The more sand we use the more we pull down the dividends, but yet if we use no sand there will be no dividends, only epitaphs.

So far I have only dealt in lbs. or tons of material per 35,000 miles. The cost in £ s. d. is as follows :—

	£	s.	d.
One set of wheels	6	0	0
Labour	6	0	0
18 sets of wheel-brake shoes	8	2	0
Labour in fixing	1	12	0
360 sets of track-brake shoes	9	0	0
Labour in fixing	5	0	0
20 tons of sand	5	0	0
Labour in filling	2	0	0
	£42	14	0
Less scrap value	1	19	0
Net total	£40	15	0

equal to ·279d. per car-mile. The wear on the rail is not included, as it is not ascertained.

It is well known that we have five cars fitted with the automatic regenerative control, and I have no doubt you will expect me to say how this affects the questions treated in this letter. One of these cars has run 17,094 miles. The wheels have lost $\frac{7}{16}$ in. in diameter; the brake blocks have not yet been changed, nor are likely to be for some considerable time. It is therefore too early to say exactly how much economy will be realised; but if the same rate of wear be maintained, the wheels and brakes will carry the car at least 70,000 miles.

Sand is used occasionally, one filling of the boxes usually lasting 300 miles in winter, and from 550 to 600 miles in summer.

J. W. Endean.

Devonport, *June 30th*, 1904.

Carbon v. Copper Brushes.

I note that Mr. W. Stepney Rawson, in a letter in your last week's issue, rather inclines to the view that the carbon brush will be so improved that copper brushes will not be used in the future. I quite agree with him that, with dynamos built on present-day lines, carbon brushes are practically a necessity, but the object of my article was to point out a means whereby that necessity might be avoided. I have no doubt that if this can be done Mr. Rawson will agree that machines with copper brushes can be built with higher efficiency and lower cost than with carbon brushes, and will be so, until Mr. Rawson, the writer, or someone else on this earth can make carbon of the same conductivity as copper ! ! !

J. W. Burleigh.

LEGAL.

South Lancashire Electric Traction Co.

Vice-Chancellor Hall, in the Lancashire Court of Chancery at Manchester, on Monday, granted an application for the appointment of a receiver in a debenture holders' action against the South Lancashire Electric Traction and Power Co. It was stated, says the *Financial Times*, that the half-year's interest due on January 1st last had not been paid, and the security had now become enforceable. Mr. John Salter, manager of the company, and Mr. Henderson, chartered accountant, London, were appointed.

Brighton Tramways.—It is reported that the Corporation electric tramways for the year ended March 31st show a deficit of £4,778. Revisions of fares (increases) are proposed.

PARLIAMENTARY.

Supply of Electricity Bill.

The Board of Trade measure to amend the Acts relating to electric lighting, came before a Select Committee of the House of Lords, presided over by Lord Wolverton, on Thursday last week.

The Hon. T. H. W. Pelham, assistant secretary of the Board of Trade, examined by the chairman, stated that under the Electric Lighting Acts, 1882 and 1888, the Board of Trade had power to make provisional orders enabling local authorities, companies, or persons to supply electricity for public or private purposes. Those orders had to be confirmed by Parliament. By the practice of Parliament, promoters, as a rule, were not allowed to proceed by Bill for electricity powers in cases where they could proceed by provisional order. There were cases, however, in which promoters were obliged to proceed by Bill—when they were seeking powers which the Board of Trade could not at present confer. The Board of Trade had no power to enable the local authority to purchase land compulsorily, or to supply energy in bulk, neither could they authorise two or more local authorities to carry out a scheme jointly. In 1898 a Joint Committee was appointed to consider the general principles of certain Bills which had been promoted for authorising certain large electric power schemes. Nine electric light companies, 12 corporations, and the L.C.C. were represented by counsel before that Committee; and the Corporation of Edinburgh and the Metropolitan Electric Supply Co. were represented by Parliamentary agents. The Bill which was now before the Committee consisted of a number of small amendments to the Electric Lighting Acts, some of which were designed to carry out recommendations made by the Joint Committee. Speaking generally, the principal object was to enable promoters to proceed by prov. order rather than by Bill, and so to save expense. The remaining clauses of the Bill were designed to remove certain practical difficulties which had been experienced in the working of the existing Acts. Practically, the Bill was the same as that submitted to the House of Lords last session, when it was read a first time. Certain objections to the Bill had been received, principally from local authorities, and he thought they could easily be met by the Board of Trade. Witness then dealt with the various clauses.

Clause 1 was to carry into effect the recommendation of the Joint Committee that undertakers, whether local authorities or companies, should by provisional order, confirmed by Parliament, be given powers of compulsory purchase for the purpose of acquiring land for generating stations. The Joint Committee stated that the proved public advantages of electrical energy in the generation of light and power, warranted, in their opinion, the granting to undertakers of compulsory powers for acquiring sites for generating stations and lands or easements, for pipes and mains therefrom, and other works. They considered that provision should be made for the granting of those powers in provisional orders, and that such provision would facilitate a continuance of the existing practice according to which more or less uniform conditions, under which undertakers were to work, were provisionally settled by the Board of Trade. The Joint Committee further stated that in their opinion procedure by Private Bill should be reserved, as at present, for exceptional cases. Witness explained that where a local authority or company applied for compulsory powers, the House of Parliament was obliged to deal with it by Bill. There was a great advantage in procedure by provisional order, as the matter was thoroughly thrashed out by the Board of Trade, and parties were heard at a nominal expense. As a matter of fact, from 60 to 100 provisional orders were passed every year, and only half a dozen or so were opposed in Parliament. He was speaking of provisional orders dealing only with electric lighting. There was another reason for giving the companies and local authorities power to take sites, it was that it simplified the question of actions for nuisance. The Joint Committee recommended that where the site for a generating station was acquired under compulsory powers, and was specified in the provisional order, the undertakers should not be subject to any further liability than that imposed by the Common Law in the case of persons exercising statutory powers and duties. At the present time undertakers could only acquire land by agreement, and consequently lands were never scheduled in provisional orders. No notice was given to owners and neighbours of the purpose for what the land was proposed to be used. Therefore a clause had always been inserted in provisional orders, that nothing should exonerate the undertakers from any proceedings for nuisance. There was one other matter dealt with in Clause 1. It provided for the purchase of land for a generating station, whether such land was within or without the area of supply. Of course, in many cases, it was very convenient that the site for the generating station should be outside a town, and consequently outside the municipal boundaries.

Clause 2 carried out further recommendations of the Joint Committee, and the question of the situation of the site came partly under this clause, although it was dealt with under Clause 1. The clause, however, dealt with the question raised by the Joint Committee as to whether, in case of a generating station, however acquired, not being situated within the area of supply, power should be given for the breaking up of streets between the station and boundary of the area of supply. Under the present law the Board of Trade, if they wished to give power to a local authority to break up the streets between the generating station and the boundary of a borough, were bound to include the outside piece within the area of supply, and that was often undesirable. The clause in the present Bill was

as follows:—"For the purpose of enabling electricity to be brought into an area of supply from a generating station situated outside that area, the Board of Trade may, by provisional order, apply to any roads, railways or tramways situated outside that area, the provisions of the Electric Lighting Acts, which authorise, or enable the Board of Trade to authorise, the breaking up of any road, railway or tramway, so far as the provisions do not already apply."

Clause 3 was as follows:—"The Board of Trade may, by provisional order,

"(*a*) Authorise any company or person to supply electricity in bulk to any local authority, company or person authorised to supply electricity in any area for the purpose of distribution by that local authority, company or person within that area; and

"(*b*) Provide for any supply so authorised being compulsory; and

"(*c*) Define what are to be the limits of supply for the purpose of the provisions of the Gasworks Clauses Act, 1847, incorporated in the Electric Lighting Act, 1882, in the case of a company or person so supplying electricity in bulk; and

"(*d*) Make such other provisions as appear to them necessary for adapting the Electric Lighting Acts to any case where a company or person are authorised to supply electricity in bulk in any area."

Speaking on this clause, Mr. Pelham said that since the Acts of 1882 and 1888 were passed there had been a great development of large schemes. Sometimes they were only for granting powers to companies to erect generating stations, and to supply power to premises, to workshops, &c., and also to supply in bulk to local authorities and companies who were authorised to supply in detail (from house to house) within their districts. In the case of those larger schemes, the companies had to proceed by Bill. The Board of Trade had only power to make provisional orders where power was sought to supply from house to house, and where the company would be under an obligation to supply where a demand was made upon them. They did not propose by the present Bill to authorise local authorities to apply for provisional orders for the establishment of one of those large power undertakings. It might, perhaps, be worthy of consideration whether a local authority should not be authorised to supply in bulk to an adjoining local authority. That was not in the present Bill, however. By paragraph 3 of the clause, as a condition of granting the order, the Board of Trade would be empowered to require the undertakers to give a supply in bulk to any local authority or company which was authorised to distribute electricity.

Clause 4 also carried into effect a recommendation of the Joint Committee. The recommendation was: "The Committee think the provisions of the Electric Lighting Act, 1888, enabling the local authority to purchase an undertaking after a term of years, inapplicable, as a general rule, to the case of an undertaker supplying energy in bulk at high voltage, but there might be special cases where it is desirable that the local authorities should have the right to purchase reserved to them. To meet such cases they suggest that the Board of Trade should have power to insert the purchase in the provisional order, if the local authorities concerned can, in the opinion of the Board, show good cause for such a course. In a previous paragraph the Joint Committee stated that the power of purchase which was given by the Act of 1888 should not apply to large power undertakings. It was inconvenient, said Witness, that different parts of an area included in one electric power scheme should be liable to purchase by different local authorities, some of whom might exercise those powers, while others might not. The effect, therefore, of the first Sub-Sec. of Clause 4 was that the Board of Trade would have power to exclude the compulsory power of purchase in the case of those large undertakings, which it was now proposed for the first time should be authorised by provisional order. As a matter of fact, Parliament, by giving powers by Act to those large power schemes, had excluded the right to purchase at the end of 42 years as was provided by the Act of 1888. He was not quite sure whether the power of purchase had been excluded in all cases. Sub-Sec. 2 of Clause 4 was then dealt with. By that Sub-Sec. of the Act of 1888 the power of purchase by a local authority related to only so much of an undertaking as was situated within the district of the local authority. The consequence was that where the generating station was situated within the district of one local authority and the whole of the supply given in the area of another local authority, and the local authority in whose area the supply was given exercised its rights of purchase, the borough would acquire the mains and other works of distribution but no generating station, because the generating station would be left out in the country in the district of another authority. The company, on the other hand, would be left with the generating station, but with no means of distribution. The effect of the proposed alteration in the law would be that the local authority or borough would be empowered to purchase the whole undertaking including the generating station.

Lord Stanley (one of the Committee) asked witness if the public authority retained the right to purchase on the same basis as before. —Witness said that that was so.

Sub-Section 3 had been inserted to meet the case where a company supplied an urban district and parts of certain adjoining districts. When the time came to purchase, the urban authority might wish to purchase, but the other authorities might not be willing, and the generating station might be situated in one of the outside districts. The sub-section would enable the outside authorities to surrender to the urban authority their powers of purchase. The clause made it necessary that the consent of the company to be purchased should be obtained.

Clause 5 was to give a power not recommended expressly by the Committee but inferred. It gave power to two local authorities to combine and work an undertaking together. They would be able to combine for purchase and working. Under the present Act there was no such power given.

Clause 6 was one that had aroused some opposition. By the Act of 1888 it was provided that "no provisional order authorising the supply of electricity by any undertakers within the district of any local authority shall be granted by the Board of Trade except with the consent of such authority, unless the Board of Trade, in any case in which the consent of such authority is refused, are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with, and, in such case, they shall make a special report stating the grounds upon which they have dispensed with such consent." The present clause proposed, in accordance with the recommendations of the Joint Committee, to provide that a company must give notice to a local authority, but should not be obliged to obtain its consent. The Joint Committee considered that the provisions of the Act of 1888 in regard to this matter should be amended, and that, while the local authority should be entitled to be heard, they should not have a provisional veto, only to be dispensed with in special cases by the Board of Trade. The power of the Board of Trade to give effect to the views of the local authority would not be diminished, and a local authority could still oppose the confirmation of the order in Parliament. It was not the wish of the Board of Trade to facilitate the granting of competing powers where a local authority was already supplying the district. In the metropolis two companies were often given powers to compete one with another, but throughout the country generally, only one set of undertakers was allowed to supply, and in the metropolis it was not usual to give a company power to supply where a local authority already had powers. If it would remove any objection on the part of local authorities, the Board of Trade would be prepared to add a proviso exempting from the operation of the clause areas in which local authorities had already obtained and were exercising powers of supply.

In reply to Lord Stanley, Witness said that he did not think the right of buying up a private company by a local authority would be prejudiced by the Bill.

Clause 7 was an alteration of Sub-section 2 of Section 32 of the Schedule to the Electric Lighting (Clauses) Act, 1899, with a view of making five years the ordinary period of revision of maximum price, instead of seven.

Clause 8 was a technical matter about a duly certified meter, into which he would not go, unless subsequently asked to do so.

Clause 9 provided that the accounts of a local authority should be made up to March 31st in each year, and contained certain other provisions as to accounts.

Clause 10 dealt with the supply of electricity to premises having a separate supply, and provided that a person should not be entitled to demand from undertakers . . . . a supply of electricity for any premises having a separate supply, unless he had agreed to pay the undertakers such minimum annual sum as would give them a reasonable return on the capital expenditure.

Clause 11 gave the Board of Trade power to exempt a company or person from any provisions in the provisional order, which would prevent the company or person from carrying into effect any contract entered into under Sec. 11 of the Electric Lighting Act, 1882.

Clause 12 contained the "definitions," and the remaining clauses 13 and 14 provided that in the application of the Act to Scotland the Secretary for Scotland should be substituted for the Local Government Board, and in its application to Ireland the Local Government Board for Ireland should be substituted. The Committee adjourned.

The Committee resumed its consideration of the Bill on Tuesday, Lord Ellesmere presiding.

At the outset of the proceedings, Mr. Moon, K.C., asked that the Metropolitan Electric Supply Co., which he represented, should be allowed to appear by counsel separately from the groups of companies already represented. That company was, he said, opposed to the Bill as it now stood, and had presented a petition against it. They had a very large generating station at Willesden upon which they had spent a million and a half of money, and they were also exceptional in that very shortly they would be undertakers in respect of four districts in London.

The Chairman said the Committee would consider the application and give their decision later on.

Lord Robert Cecil, K.C., asked that the Metropolitan Borough Councils should be allowed to be separately represented against the Bill. The Committee granted this application.

Mr. Fitzgerald, K.C., on behalf of the Municipal Corporations' Association, said that there were four points in the Bill to which that Association took objection. The first point dealt with the compulsory acquisition of land which was provided for in Clause 1 of the Bill. The general rule of Parliament had been not to give power to take land compulsorily by provisional order, although, of course, there were exceptions. The Electric Lighting Acts proceeded on that general basis, and under these Acts there was no power at the present time for the Board of Trade to give compulsory powers. It was proposed under the Bill to alter that arrangement, and after having considered it very carefully, the Municipal Corporations' Association took considerable objection—not to the whole proposal, but to a proposal to allow land to be acquired compulsorily outside the area of the company or authority who were going to supply, unless with the consent of the local authority in whose area the land proposed to be taken was situated. The ground of that objection was partly this—that if they gave a company or local authority power to acquire land outside their district, it necessarily involved along with that the right to break up the streets and roads. It was very inconvenient to give undertakers general powers to break up roads in that manner. The procedure by provisional order was eminently suited for cases which were non-contentious, and that was the case

with the bulk of the electric lighting orders which the Board of Trade granted. That procedure had worked expeditiously and economically. If this Bill was passed in its present form in future these large power Bills might be dealt with by provisional order, and there would be no local inquiry. The Association he represented strongly objected to any such power being placed in the hands of a Government department. The only effect of granting such powers would be that the real fight would take place in Parliament afterwards, when the provisional order came up for confirmation, and any expense that had previously been incurred before the Board of Trade would simply be money thrown away. Another matter in the Bill to which the Association took exception, was the power contained in Clause 4, the first sub-section, empowering the Board of Trade to dispense with or to over-ride the right of the local authority to purchase the undertaking at the end of 42 years, which right was given by the existing Electric Lighting Act of 1888. Parliament had always, except in very exceptional cases, acted in that way when granting electric lighting orders, and he contended that such an exemption ought to be left to be dealt with by a Committee of Parliament, and not by a public department. A matter also of considerable importance was that referring to the consent of the local authorities in regard to giving a competitive supply. Under Clause 6 of the Bill it was proposed to dispense with the necessity of the consent of the local authority to the grant of a provisional order. The existing law, he submitted, was quite sufficient for all the purposes of the case, as contained in the first section of the Electric Lighting Act of 1888. That clause, he thought, was to be looked at as a sort of compromise that was then arrived at between the local authorities on the one hand, and the Government department on the other. He had no reason for saying that that provision had not worked well. If the Board of Trade came to the conclusion that the local authority ought to have consented, they could dispense with their consent, but they were placed in the position of having to give their reasons for dispensing with their consent, in the shape of a special report to Parliament. Why should not that procedure be continued under the present Bill? He should have thought that there was no objection on the part of the Board of Trade to publicly state their reasons for dispensing with the consent of a local authority. It was a matter of considerable importance that the local authorities should know the reasons which governed the decisions of the Board of Trade, and that Parliament should know the reasons as well. He listened carefully to the evidence given by Mr. Pelham last week, and he did not gather that the present procedure had occasioned any inconvenience to anybody.

Lord Stanley: Do I understand that you are instructed to object absolutely to any compulsory power of acquiring land outside the area to be served by a provisional order?

Mr. Fitzgerald: Yes, without the consent of the local authority in whose area the land is to be taken. Such power would involve the breaking-up of streets, and the consent of the urban district authority ought first to be obtained. Replying to the chairman, counsel said that no question of compensation arose—it was merely a question of the public convenience.

Mr. T. H. W. Pelham said that in accordance with his promise last week, the Board of Trade had considered an amendment to Clause 6 of the Bill to meet the case of certain boroughs and local authorities who were afraid that the clause would give facilities to companies to compete with the local authority, who had already obtained powers to supply. It was proposed to amend Clause 6, Sub-section 1, to read as follows:—"Provided that this sub-section shall not apply to any provisional order authorising a company to supply electricity otherwise than in bulk, or for power purposes only so far as the order relates to any district in which a provisional order is in force authorising the local authority to supply electricity." The present policy of the Board of Trade was not to give competing powers where already there was a local authority or a company in possession. That policy was subject to some modification in the case of London, but still there was no doubt that the Act of 1888 distinctly provided that no monopoly should be given to anybody, and it was open to the Board of Trade to grant a competing order. The effect of the amendment he had submitted, would be that if a company were to come forward to compete with a local authority who were already supplying, they would have to obtain the consent of the local authority. Under the existing statute they would not be able to proceed under the new procedure, which had been recommended by the Joint Committee, and which was incorporated in the Bill—there being still, of course, power with the Board of Trade to dispense with the consent of the local authorities, on stating their reasons to Parliament. He was prepared to take Sub-section 2 of Clause 6 out of the Bill.

Some conversation then took place between counsel and the Committee as to the method of procedure, and after a short adjournment, the Chairman said the Committee had decided to hear counsel for the Metropolitan Electric Supply Corporation. With regard to the general procedure, it must be remembered that the Bill had been thoroughly thrashed out before a Joint Committee of both Houses of Parliament, and therefore it was to be hoped that counsel would make any general statements as briefly as possible, in order that the Bill might be considered clause by clause.

Mr. Pelham said that in order to meet the objections raised by Mr. Fitzgerald, on behalf of the Board of Trade he was willing to insert a clause providing that when large power schemes came before them, they would direct the procedure to be by Bill, instead of by provisional order, following the lines of the Scotch Local Government Procedure Act, and, further, to provide that in the case of mains laid in roads outside the district of the area of supply, the consent of the local authority should be necessary to the breaking-up of a road, unless the Board of Trade saw fit to dispense with such consent.

The Committee then adjourned until Thursday.

Great Yarmouth Tramways Bill.

The Bill promoted by the Corporation of Great Yarmouth for the construction of tramways and other improvements, came before the Police and Sanitary Committee of the House of Commons on June 28th, Mr. Wilson presiding.

The case for the promoters was opened by Mr. Pritchard. There were eight lines of tramways proposed by the Bill. The Corporation obtained powers to construct tramways in 1899, and the lines were opened in May, 1902. The new tramways would be worked on the overhead system of traction. The Corporation were empowered to purchase the undertaking of the Gorleston Tramways Co., and when this was done the lines belonging to that company would be electrified. The Corporation also asked for power to run omnibuses "within the borough in connection with the tramways of the Corporation when the running of cars thereon is impracticable or pending the construction, reconstruction, alteration, or repair thereof, or in the extension of any of such tramways, and also for testing the amount of traffic along any route or between any particular points and without the borough along the route of Tramway No. 3.

Mr. Cockbill, the borough surveyor, stated that his estimate of the cost of construction of the proposed new lines was £76,717, while that of the reconstruction and equipment for electric traction of the lines of the Yarmouth and Gorleston Co. was £8,000.

There was no opposition to the Bill. After hearing further evidence, the Committee found the preamble proved.

Mr. J. W. Wilson, the chairman of the House of Commons Committee considering the Bill, in his report to the House, states that it authorises the Corporation of Great Yarmouth to construct and maintain tramways beyond the borough, viz., in the rural districts of East and West Flegg, but such tramways will be in connection with the tramways authorised to be constructed by the Corporation within the limits of their district. The Committee are of opinion that having regard to the special local circumstances such construction ought to be allowed. The length of the tramways outside the borough is 6 furlongs 8·30 chains.

Metropolitan District Railway.

A Select Committee of the House of Commons, under the Chairmanship of Sir Lewis McIver, had before it, on June 29th, the Bill promoted by the Metropolitan District Railway. The Bill is an omnibus measure under which the company seek various powers in connection with the electrification of the railway now being proceeded with. The London County Council and Fulham Borough Council opposed the Bill, in so far as it proposed to institute "zone" fares over the railway, and to restrict the weight of free luggage allowed to passengers, and the L.C.C., who were represented by Mr. Coward, K.C., pressed the Committee to add the workmen's trains clause to the proposed deep-level line.

Mr. Freeman, K.C., in opening the case for the promoters, said that in the first place the company wished for an extension of time to 1908 to complete their deep level line between Earl's Court and the Mansion House, which Parliament had already authorised. The work of electrifying the District Railway would be completed within a few months, but until it was finished it was difficult to say exactly what effect it might have upon the deep-level line. The London County Council had taken advantage of this application to ask the Committee to insert a clause making the company apply the provisions of the Workmen's Trains Act to the Bill. He would like to point out, however, that that question was gone into very fully in the original Bill of 1897, and Parliament then decided that the matter was fully covered by the provisions of the Cheap Trains Act, 1883. The company contended then, and they still adhered to that contention, that the deep-level railway was not intended for the convenience of workmen. At present they ran 27 workmen's trains per day, and, according even to a report of the London County Council made in 1902, the service was arranged to meet all requirements. The deep-level line was to be constructed underneath the existing railway, and under Sec. 32 of the Bill they proposed a change of fares, and the grouping of stations under certain rates. The idea was to develop the long-distance traffic from the suburbs to the city. The fares to the distant stations would be reduced, but the short-distance fares would be slightly increased, although they would still be kept within the statutory limit. Under the Bill, 947 zone fares were scheduled—479 at 2d., 306 at 3d., 142 at 4d., and 20 at 5d. Under the new arrangement, 117 short-distance fares would be increased, 47 would remain unaltered, and in 783 cases there would be a reduction. It was further proposed that a passenger travelling by the zone fare should be restricted to 28 lbs. weight of luggage. The District Railway was never intended to deal with heavy luggage, and the amount specified would be all that was necessary for the convenience of the public. When the Bill was before the Lords, the promoters had agreed that they would run two trains per day for the accommodation of passengers travelling with any considerable quantity of luggage. It was worthy of note that, although the line passed through the areas of 15 local authorities, Fulham was the only local body that had any objection to the zone fares.

Mr. R. W. Perks, M.P., the chairman of the promoting company, in answer to counsel, said that until they had got the present line running by electricity, it was not desirable that they should commence the construction of the deep-level railway, as they were not quite certain as to what would be the effect of the increase of trains upon the upper lines. They had entered into arrangements with the Brompton and Piccadilly Railway Co., who would construct the section between Earl's Court and South Kensington, by which the District Railway would reserve the right to use it as part of their deep-level system. On the subject of workmen, the witness

explained that at present the company was running 115 trains per day for which workmen's tickets were issued. The number of workmen carried at these cheap fares had enormously increased. Thus, in 1892, they carried 4,000,000; in 1901 the number had risen to 7,000,000, and at present they were carrying about 13,000,000 each year. The proposed deep-level line would be under the existing railway throughout its whole length, with the exception of a short bit under the Embankment. Asked to give an example of the establishment of zone fares, witness said that, taking Ealing to the Mansion House, the fare would be only 3d., as against the present charge of 5d. He did not know what the effect of the change of fares would be, and therefore did not wish to substitute the zone fares for mileage rates, as it might prove a financial loss, in which case the company would have to fall back upon its statutory powers. If trains were run by electricity at very short intervals, it was necessary that the amount of luggage carried should be restricted to that proposed in the Bill.

Replying to the Chairman, the Witness said it was hoped that the line would be working electrically before Christmas; and they would not care to commence the construction of the deep-level line until they had seen the result of the working by electricity.

The Chairman said that what the Committee wanted was a distinct assurance that it was the intention of the promoters to proceed with the work.

Mr. Freeman replied that he had no hesitation in giving that assurance on behalf of the company, and notices would be served within the time asked for in the Bill.

After hearing counsel in opposition to the Bill, the Committee eventually found the preamble of the Bill proved.

Sir Lewis M'Iver, reporting from the Committee on Group No. 10 of Railway Bills, states that in the case of the Metropolitan District Railway Bill they had agreed to the following report:—

That the Bill does not authorise the construction of any new railways. That the Bill authorises the company to charge "zone" fares for the conveyance of passengers between certain stations on their system set out in a Schedule to the Bill. That a report from the Board of Trade under Standing Order No. 145A was referred to the Committee and considered by them. The report stated that as the "zone" fares may be expected to encourage the residence in the outer suburbs of persons occupied daily in London, and increase the rapidity of transit within the metropolitan area, the proposals of the Bill are such as to merit the favourable consideration of Parliament. The Committee found that a recommendation of the Board of Trade had been given effect to during the progress of the Bill in the House of Lords. That the Committee, after hearing evidence in support of the Bill, are of opinion that the "zone" fares should be sanctioned.

The Tramway Running Powers Question.—Tyneside Tramways and Tramroads Bill.

The Select Committee of the House of Commons, presided over by Sir E. Strachey, which considered the above Bill, met on Wednesday morning to decide as to the course of procedure to be adopted in consequence of the House of Commons having sent the Bill back to them to further deal with the clauses giving the company the right to run over the lines of the Newcastle-on-Tyne Corporation.

The Chairman said: This Bill has been referred back by order of the House to consider the running power clause. There was no instruction given to the Committee, and the Committee have an absolutely free hand as they had before. The trend of the debate was, that the Corporation and the company ought to have come to an agreement before the Committee that, in case of sale, no increased value should accrue on account of the running powers given. The Committee take it that, as regards the Tyneside Co., they will not want to call fresh evidence, but only to rebut, if necessary, any further evidence given by the Newcastle Corporation for the purpose of trying to show that the previous unanimous decision of the Committee was wrong and requires revision. If this is assented to by the Tramway Co. the Committee would like to know whether the Corporation desire to offer fresh evidence against running powers or make any fresh proposal with regard to running powers by agreement over the two tramway systems. Further, does the Corporation desire to ask for protection in case of sale by the company to the Corporation or any other party in regard to any increased value of the company's tramways owing to running powers having been given to the company? It will be well if the representatives of the Tramway Co. will say if they wish to call fresh evidence.

Mr. Souttar (for the company): We quite concur in the proposed course of procedure. Of course, we understand there is in the air some idea of a proposal being made. It seems to us that any such proposal should come from the Corporation.

The Chairman: Quite so.

Mr. Souttar: And it is very desirable that it should come immediately, considering the lateness of the session. Failing that, it would be desirable that the Committee should appoint as early a day as possible for further hearing.

Mr. H. R. Cripps (for the Corporation) said the Committee would understand that this was not a matter which could be proceeded with and dealt with as if it was an individual they were concerned with. He had to apologise for the absence of the town clerk who had been called to Newcastle, and he would point out that the Corporation were in some difficulty, because the officers principally concerned were in London before a Select Committee on another Bill. Therefore there was little time for the Corporation to devote to the matter in the immediate future, but probably in the course of next week they would be able to deal with it. It would necessitate the meeting of two committees who would have to report to the Council, and the Council would have to consider their report; and he had no doubt there would be a proposal for a meeting between the Corporation and the company.

The Chairman said the Committee would like an answer to the two questions. No doubt the Committee would do all they could to meet the convenience of the Corporation, but the Committee had to arrange to meet again, and the Corporation must be prepared to meet them.

Mr. Cripps said there was no desire to delay the matter. It was a matter the Corporation would consider very carefully.

The Chairman: I should think they have considered it very carefully. I do not think you need argue that. The Committee will not admit that for a moment.

Mr. Cripps said the Corporation appreciated what took place in the House, and he understood that the matter would be approached from quite a different point of view than was the case when the Bill was first before the Committee.

The Chairman: I would like you to answer the two questions, if you can.

Mr. Cripps said the necessity for coming before the Committee again, would depend to a large extent upon what took place between now and when the Committee sat again.

The Chairman: No; it will have to come before the Committee again.

Mr. Cripps: I mean the question of offering any fresh evidence.

The Chairman: They certainly know whether they wish to do that, or to bring up an agreed proposal between themselves and the company, as regards these running powers, and also as regards the question of unearned increment.

Mr. Cripps said he was in a little difficulty, because it depended upon the terms of the proposal.

The Chairman: That is for you to settle between the company and yourselves as to bringing up an agreed clause. There is no difficulty in that.

Mr. Cripps said if it could be arranged, there would be no reason to trouble the Committee, but there might be some details which they might want to leave to the Committee in any arrangement they made. What they desired to do would depend upon how far they could agree, and upon what points they would have to ask for a decision of the Committee.

The Chairman: Then you do not desire to say anything more to the Committee at the present moment?

Mr. Cripps: I do not want to commit the Corporation to say they will come to an agreement.

The Chairman: Certainly not, but are you prepared to say now that you are quite willing to enter into treaty with the Tramway Co. on these two points?

Mr. Cripps said the representatives of the Corporation present said they were perfectly prepared to negotiate with the company, and probably the best way to commence these negotiations would be for a meeting between them rather than for a proposal to be made formally by one side or the other. He understood that arrangements were being made in Newcastle for a special meeting of the Committees and Council in order that the matter might be brought forward, and he asked the Committee not to meet the following week.

Mr. Souttar said they ought not to meet later than Thursday or Friday in next week.

Mr. Cripps said he was afraid, if that were done, it would defeat the object with which the Committee had met that day. He took it that the Committee desired to suggest to the Corporation that there should be a meeting to see if the difficulty could be got over by arrangement.

he Chairman: This has not been freshly sprung upon the Corporation. It must have been in their minds for a considerable time. At this period of the session, the promoters are naturally anxious to bring the matter to a termination.

Mr. Cripps said he quite appreciated that, but the Bill had practically reached its last stage. Of course, it would have to go before the House of Lords, but that would be only formal.

The Chairman: How can you guarantee that?

Mr. Cripps: So far as the Corporation is concerned.

Mr. Souttar said that, in the event of no arrangement being come to, they might have to face opposition at a later stage in the House, and that would be serious for them. They were anxious to avoid delay. If the Corporation were serious in their intention to make an offer they would have plenty of time to consider it before Thursday or Friday.

Mr. Cripps said the difficulty was that before any formal offer could be made the Council must meet. The Tramways and the Parliamentary Committees would have to consider what they would put to the Council. That could not be done in a day or two.

The Committee sat in private to consider the matter, and on the public being re-admitted, the Chairman said:—In view of the agreement arrived at on August 25th, 1903, between the Tyneside Co. and the representatives of the Newcastle Corporation, the Committee desire the parties to draw up and submit a clause upon some such basis, and providing that, in the case of sale, no increased value shall accrue in consequence of such agreement as to running powers. The Committee will adjourn until Tuesday, July 19th, at 11.30, and the Committee wish to state that, if no agreement is arrived at, the Corporation must be prepared to go on with the case, and bring any fresh evidence they desire against Clauses 15 and 16.

Standing Orders.—On Monday the Examiner found that Standing Orders, not previously complied with, have now been complied with in the case of the Bristol Tramways Extension Bill and the Manchester Corporation Tramway Bills.

L.C.C. Tramways.—The Camberwell Borough Council have deposited a petition in the Private Bill office of the House of Lords in opposition to this Bill.

Leeds Corporation Bill.—A Committee of the House of Commons, under the chairmanship of Mr. Heywood Johnstone, has considered the Leeds Corporation Bill, which seeks to consolidate the various

local Acts relating to the borough. Clause 82 of the Bill dealt with the question of the charges for passengers on the Corporation tramways, and it was pointed out by Mr. Jeeves, who appeared for the promoters, that, under the present Acts, there were two contradictory powers in operation. What was asked for now was a similar provision to that given in the Birmingham Bill of last session, viz., power to charge 1d. per mile or 1d. per stage, the stages being laid out so as to be not less than 1 mile. He believed, however, in Leeds, the minimum stages would be about 1½ miles and would go up to about 2 miles for 1d. The Committee allowed the clause. Mr. Jeeves also asked for a new clause—Clause 85—which provided for the running of through cars, and for the charges. In Leeds it was necessary at times to prohibit anyone getting on a car going to the far end of the route unless the person was going to travel the whole distance, or was willing to pay the full fare for the whole journey. The clause was allowed, as were also clauses dealing with workmen's fares and the disposal of left luggage, &c.

London United Tramways Bill.—This Bill should have come before a Select Committee of the House of Lords on Tuesday, but as no parties appeared in opposition thereto, the Bill was ordered to be referred to the Committee on Unopposed Bills.

Stretford U.D.C. Bill.—The West Manchester Light Railways Co., and the British Westinghouse Electric & Manufacturing Co., Manchester Corporation, Lancashire County Council, and the Manchester South Junction and Altrincham Railway Co. are petitioning against the above Bill.

Electric Lighting Provisional Order (No. 4) Bill.—This Bill came before a Select Committee of the House of Lords on Monday, but as no parties appeared in opposition thereto, it was referred to the Unopposed Bill Committee.

BUSINESS NOTES.

Electrical Wares Exported.

Week ending July 7th, 1903.

Alexandria		Value £39
Amsterdam		45
Auckland		135
Bahia		11
Batoum		80
Beira		60
,,	Teleg. mat.	251
Buenos Ayres.	Elec. fuses	28
,,	Teleg. mat.	209
Calcutta		1,435
,,	Teleg. mat.	69
Cape Town		485
Colombo		74
Durban		1,117
,,	Teleg. mat.	126
Dunkirk		20
East London		289
Gibraltar		50
Gothenburg		196
Hamburg		329
,,	Teleg. mat.	140
Lisbon		112
,,	Teleg. mat.	110
Melbourne		325
Monte Video		33
Montreal		68
Napier		10
Odessa		25
Oporto		557
Otago		39
Perth		45
Port Elizabeth		144
Port Said		94
Rio Janeiro.	Teleg. apparatus	2,687
St. Petersburg.	Teleg. cable	95
Singapore		182
,,	Teleg. mat.	26
Stockholm.	Teleg. mat.	76
Sydney		367
,,	Teleg. cable	250
Wellington		1,335
Yokohama		362
Yokosuka		54
,,	Teleg. apparatus	641
Zanzibar		305
Total		£13,114

Week ending July 5th, 1904.

Adelaide		Value £254
Aden		42
Alexandria		92
Algoa Bay		35
Amoy		21
Amsterdam		144
Bombay		547
,,	Elec. machinery	304
Bordeaux		17
Brisbane		45
,,	Teleph. cable	334
Brussels		90
Buenos Ayres		104
Calcutta		744
,,	Elec. machinery	120
,,	Teleg. mat	90
Cape Town		222
,,	Teleg. cable	30,960
Colombo		96
Constantinople		15
Durban		870
,,	Elec. machinery	1,809
,,	Teleg. mat.	184
East London		689
,,	Elec. machinery	33
Flushing		29
Fremantle		232
Halifax		150
Hamburg.	Teleg. mat.	250
Hong Kong.	Elec. machinery	401
Lisbon.	Teleph. mat.	653
Lyttelton		350
Mauritius		38
Melbourne		390
,,	Teleg. mat.	640
Penang		150
Perth		28
Piræus		100
Rio Janeiro		19
Rotterdam		42
,,	Teleg. cable	400
St. Petersburg		1,055
Sekondi		12
Shanghai		10
,,	Teleg. mat.	73
Singapore		24
,,	Teleg. mat.	384
Sydney		276
,,	Elec. cables	2,900
,,	Elec. machinery	992
,,	Teleg. mat.	23
Wellington		134
,,	Teleg. mat.	667
Yokohama		510
Total		£48,739

Foreign Goods Transhipped.

Brisbane.	Elec. mat.	Value £13
Melbourne.	Elec. mat...	18
Rio Janeiro.	Teleph. appar.	229
Yokohama.	Elec. goods	33
Total		£288

East London.	Elec. m'chy.	Value £401
Rangoon.	Elec. appar.	30
Total		£431

Brush Contracts.—The Brush Electrical Engineering Co., Ltd., have secured the following contracts:—

City of Birmingham Tramways.—10 double-deck cars with Brush trucks and equipments.

Birmingham and Midland Tramways.—Six double-deck cars with Brush trucks and equipments.

Cork and Muskerry Railway Co.—One 12-in. steam locomotive.

Chesterfield Corporation.—12 car-bodies with Brush trucks and Westinghouse equipments.

The Aron Portable Meter.—The following particulars relate to the new pattern Aron portable standard meter, which the General Electric Co., Ltd., of 71, Queen Victoria Street, E.C., are just now placing on the market. This meter has been manufactured to meet the want, which has sprung up in connection with the management of the meter department of electrical undertakings, of a satisfactory means of checking the accuracy of consumers' meters *in situ*. In a great many cases it is found that the removal of a contested meter only results in proving its accuracy, and thus entails considerable needless expense. By the use of the Aron portable standard, the necessity of removing meters for testing is obviated, and the accuracy of contested meters may be proved or disproved in position.

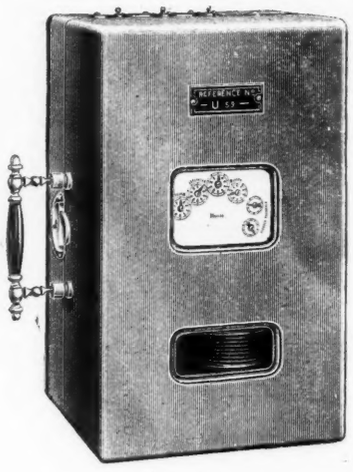


Fig. 1.

In general principle the meter is the same as the Aron meter in any of its numerous forms, though arranged slightly differently to suit the particular class of work which it has to perform. Fig. 1 shows the general external appearance of the instrument, and fig. 2 shows the meter open and with its flexible leads connected as when testing another meter.

The main points of difference between the portable type and the ordinary type of Aron meter may be noted in the second illustration, and are briefly as follows:—The pendulums are balanced

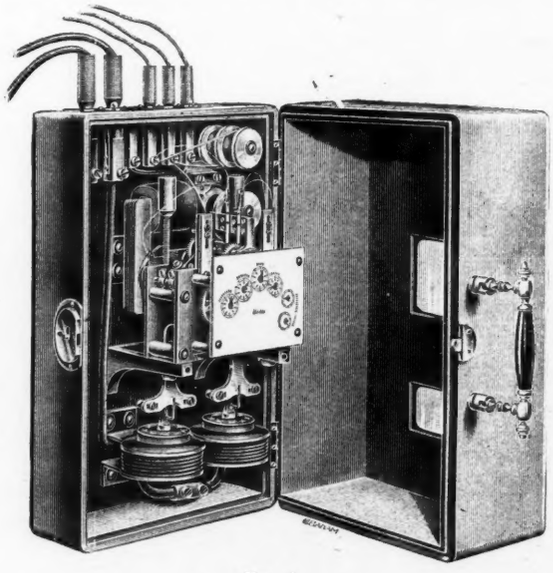
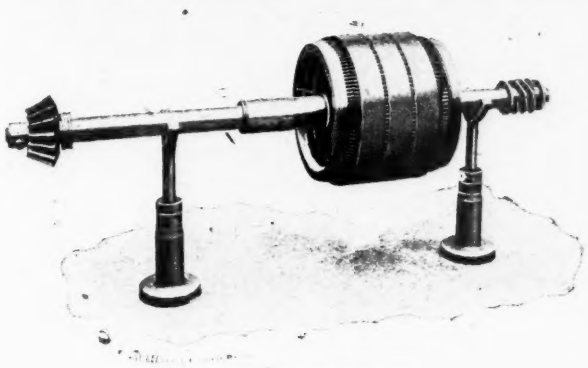


Fig. 2.

and controlled by springs, which has the effect of making the meter more sensitive and independent of being set perpendicular, any ordinary table or floor being sufficiently level for testing purposes. The connections are all on the top of the meter case, and are of the plug type.

The meter shown in the illustration is arranged for 10 amperes at either 200 or 400 volts; it can also be arranged with any amperage up to 500 amps., and any voltage or combination of voltages, indeed, the same meter may be made to serve for 200 and 400 volts, both alternating and direct. This, of course, makes the meter a universal standard, and, combined with its extreme portability and accuracy without special precautions as to levelling, makes it a most useful instrument in any test room equipment.

Short-circuiting Rotors of Induction Motors.—This process, which is being applied by Messrs. Mavor & Coulson, Ltd., of Glasgow, has reference to alternating current induction motor rotors carrying embedded short-circuited conductors. In such rotors as heretofore constructed with embedded lengths of high conductivity metal united at their ends to common conductors, it has been found difficult, if not impracticable, to provide such electrical and mechanical connection between the said lengths and the common conductors uniting them electrically and mechanically at their ends, as would not cause



View of Completed Rotor.

either at first or ultimately, the production of detrimental resistance. In this invention, in order to obviate the above disadvantage, the lengths of high conductivity metal are united and electrically connected by high conductivity metal, fused to, or fused and run upon, the ends of the said lengths. The fusion between the lengths and common end connections might be effected electrically, but it is preferred to first melt the metal which is to constitute the common connection and then to cast the melted metal upon the projecting ends of the before-mentioned lengths, whilst the armature is held with the ends of the lengths in the channel of a mould, such as may be made up with rammed sand. The projecting ends of the lengths of high conductivity metal may be appropriately divided or otherwise shaped or adapted to ensure intimate union with the fused metal cast around them.

Phoenix Motors.—Messrs. Paterson, Cooper and Co., Ltd., of London and Paisley, have received a repeat order for the supply of their Phoenix enclosed motors from Messrs. Matthew T. Shaw & Co., Ltd., Millwall, E.

The Zoelly Steam Turbine.—We understand that Messrs. Escher Wyss & Co. have a considerable number of Zoelly steam turbines in course of construction for different parts of the world, and we are informed that all the tests hitherto made have given very satisfactory results.

Quick Work.—Messrs. Graham, Morton & Co., Ltd., of Leeds, whose recent enterprise has been so strikingly shown, have sent us particulars of some work which they have lately carried out in the way of iron roof building, which, it is contended, constitutes a record. The work consisted of structural alterations and extensions carried out at the Central Station, Leeds. A new platform had to be built, other platforms lengthened, and the whole roofed in, some 36,000 sq. ft. of space being covered. The time given for carrying out the work was nine weeks and three days, but it is stated that the whole was completed within less than one month from the letting of the contract, notwithstanding that the heavier work had to be done between Saturday night and early on Monday mornings, so that traffic should not be disorganised.

Annual Outing.—The employés of Messrs. Escaré and Denelle, French art metal workers, of Wardour Street, W., partook of their annual outing on Saturday, June 25th. Some 50 in number took train to Arundel, and dinner was served at the Bridge Hotel. Mr. H. Finch proposed the toast of "The Firm," and this was seconded by Mr. Humberstone. The secretary of the Loan Club, Mr. W. H. Wilson, said the funds from the small weekly subscription, together with the accumulated interest, had well covered expenses, and he had much pleasure in handing each one a packet of money. The managing director, Mr. Ch. Maurice Escaré responded to the toast. Littlehampton was visited and a ramble round Arundel was enjoyed.

Robertson Electric Lamps, Ltd.—The employés of this company had their annual excursion on Saturday last, July 2nd. About 400 proceeded by special train from Victoria to Folkestone, where a pleasant day was spent, the weather being perfect. The staff of the company had their annual dinner on the same occasion at Foster's Dover Castle Hotel, after which they proceeded in brakes through the country to Newington. Here, at the Royal Oak Hotel, various forms of amusement were indulged in, and finally tea and strawberries were partaken of on the lawn. The return was made to Folkestone in time to catch the special train to town. Arrangements were well made and carried out, resulting in an enjoyable time.

Hydro-Electric Hotel Plant.—Messrs. James Gordon and Co. have secured a contract for a complete hydro-electric plant for an hotel in Wales, comprising the construction of a storage reservoir for water, providing and laying nearly ½ mile of piping, and the supply of one of their special double-discharge high-pressure turbines direct coupled to a dynamo, together with all the necessary electric plant and wiring.

Fire Alarm Contracts. — The following is a list of some of the firms with whom the May-Oatway Fire Appliances, Ltd., have lately placed contracts:—Hay Bros. & King's Theatre, Glasgow:—Carrick & Topping; the premises of the Provident Co-operative Society, Leith:—W. Douglas, Ltd.; the premises of Adam Smail, Dundee:—J. Maxwell & Son; the premises of E. Chalmers & Co., Leith:—D. T. Niell & Co; and the premises of the St. Mungo Manufacturing Co., Govan:—Carrick & Topping.

"Eburin."—An insulating material intended to replace ebonite for many purposes, and already well known on the Continent, is being introduced to this country by Messrs. A. & E. Cohen, of 2, Bury Street, St. Mary Axe, E.C. This substance, which is named "Eburin," is capable of being moulded at a temperature of 250° F.; it does not absorb water, and possesses high insulating qualities. Special moulds have been made for producing a variety of electrical accessories of "Eburin"; it can also be supplied in rod and sheet, and is capable of machining, whilst judging from some samples submitted to us, the material, which is jet black in colour, is susceptible of a high polish. "Eburin" is recommended by the makers for tramway accessories, switchboard work, lamp-holders, and all other purposes where metal parts are employed in conjunction with a highly-insulating material.

As compared with ebonite, the material is more brittle, and has a much lower tensile strength; it ought, therefore, to be used in compression. Its density is about twice that of ebonite, but, nevertheless, it is stated that the price is considerably lower.

Catalogues and Lists.—A bulletin of stationary and portable motor-driven air compressors has been received from the National Electric Co., of Wilwaukee.

We have received from the Chloride Electrical Storage Co., Ltd., of Clifton Junction, Manchester, a copy of the latest edition of their catalogue of the Highfield patent reversible booster. A description of the booster for traction work is given, together with some notes respecting efficiency, cost, size of battery, and so on. The three-wire booster for lighting and power systems, and switchboards for same are particularised, and a list appears of some of the lighting, tramway, and railway systems in this and other countries in connection with which the Highfield booster does service. A number of interesting diagrams are given showing battery and booster curves for various systems. Power station engineers will find the list of service.

An illustrated circular has come to hand from Messrs. James Dawson & Son, Ltd., showing views of the different departments at their Boultham Leather Works, Lincoln, where their leather, link, and Balata beltings are manufactured.

A list of the "Stockall" time recorder has been sent to us by Messrs. J. J. Stockall & Sons, Ltd., of Clerkenwell Road, E.C.

Messrs. W. H. Bailey & Co., Ltd., of Salford, have just issued their No. 93 catalogue relating to their "full-bore" reducing valves (Foster's patent) and pump governors. Many detailed and exterior views are given, together with notes for fixing and using, in the course of the 52 pp.

The Atlas Carbon and Battery Co., Ltd., of Ewer Street, S.E., have just brought out a 24-pp. price list detailing their specialities in Leclanché batteries, "Dania" dry cells, carbon brushes, &c.

Mr. Arch. J. Wright, of Upper Street, N., is sending out a June list of some of his automobile electrical accessories.

Section I. of a new edition of the catalogue of Messrs. Nalder Bros. & Thompson, Ltd., has been published. It describes the firm's soft-iron solenoid instruments of switchboard and portable patterns, accumulator cut-outs, &c. Many illustrations of the various instruments, and typical scales, are given, prices and code-words being conveniently set out. Several views of the firm's works at Dalston appear.

Mr. W. Clark Fisher, of Gordon Works, Ealing, W., is now issuing some new illustrated and priced pamphlets. One relates to his "Column" and "Stump" galvanometers, galvonometer bracket combined with lantern and scale, combination galvanometer tester, and other details; the second list describes the "compensating potentiometer, and adjuncts therefor.

Messrs. E. P. Allam & Co., of 11, Hatton Garden, E.C., have sent us some new illustrated price lists of their "Premier" iron-clad switches, cut-outs, house service fuse boxes, and motor starters.

Tramcar Claim.—At the Dewsbury County Court last Friday, the hearing of an action in which Sarah Emma Wharton, widow, Batley Carr, Dewsbury, sought to recover £281 7s. 8d. from the Yorkshire (Woollen District) Electric Tramways Co., Ltd., was resumed. Mrs. Wharton, it was alleged, had suffered from injuries sustained by being knocked down by an electric car on January 1st last, and negligence was alleged on the part of the driver of the car. On the other hand, it was stated in evidence that plaintiff had admitted that she lost her head when crossing the road. A verdict was given for defendants, without costs.

Meldrum Stokers.—The Metropolitan Asylums Board has accepted the tender of Messrs. Meldrum Bros. for fixing mechanical stokers at the Grove, Park, and Northern Hospitals.

Book Notices.—We have received a copy of the 1904 issue of *American Street Railway Investments*. The publication has reached its eleventh annual edition, and is known as the "Street Railway Red Book"; it is the annual financial manual of street railway and traction companies brought out by the publishers of the *Street Railway Journal*. This year's volume is larger than any previous edition, and contains reports of a considerable number of companies which hitherto have not presented financial statements. In addition to a large increase of information of this character, the publishers have added a number of other features of value, among them the location of power stations and repair shops, parks and pleasure resorts, and more complete descriptions of the funded debt of the different properties. A large number of maps of the principal street railway systems in the country are included, also maps showing the inter-urban railways in New Jersey, Ohio, Indiana and Illinois. The figures recorded of the earnings of the different properties as reported this year, shows that they have kept up, in spite of the decrease in many of the steam railroads and manufacturing properties, and as a whole, the industry is said to be in a prosperous condition. In a comparison for 1903 and 1902 of the gross receipts of 310 companies, the average increase is 8·5 per cent. The London office of the *Journal* is at Hastings House, Norfolk Street, W.C.

Report of the United States Commissioner of Fish and Fisheries for the year ending June 30th, 1902. Washington: The Government Office.

"Berechnung und Entwurf Elektrische Maschinen, Apparate und Anlagen." By Dr. F. Niethammer. Vol. I., Direct current machines. Stuttgart: Ferdinand Enke, M. 16.

"Science Abstracts," June 25th, 1904. A.—Physics. B.—Electrical Engineering. London: E. & F. N. Spon, Ltd. 1s. 6d. each, net.

"Fire Prevention on Board Ship." By E. O. Sachs. Publication No. 85. London: The British Fire Prevention Committee. 2s. 6d.

"Les Accumulateurs Electriques." By L. Jumau. Paris: Ch. Dunod. 27fr. 50c.

"Record of Transactions of the Junior Institution of Engineers." Vol. XIII. Edited by Walter T. Dunn, Secretary. London: Percival Marshall & Co. 10s. 6d.

We have received a copy of a "Citizens' and Visitors' Guide to Places of Interest" in Bristol, issued by the Bristol Tramways and Carriage Co. The places are arranged alphabetically: the name of the line by which to travel is opposite the place of interest, and also the fare from the Tramways Centre. In addition to the foregoing information, there is a route map of the electric tramways. The guide is printed on one sheet, and folded to fit the waistcoat pocket. A supply of these is carried in every car for gratuitous distribution to passengers. Mr. Challenger, the traffic manager, has hit upon this means of showing at a glance to visitors to Bristol and the residents, how the tramways serve as a means of reaching the many places of attraction.

The Electrical Ore Finder.—The *Financial Times* says that accepting the challenge of certain owners of mines in the Coniston district near Barrow-in-Furness, the "ore finders" will shortly leave London for the purpose of locating mineral lodes. "The experiments will be carried out entirely at the expense of the Electrical Ore Finding Co., in order to prove whether it is worth while spending further local capital upon what has up to now been profitless effort. Upon metalliferous lodes being located by the electric waves a bore or shaft will be sunk to verify the indications. The experts are confident that the results will be made public within 10 days."

Trade Announcements.—Messrs. Frederick Smith & Co. Wire Manufacturers, Ltd., of Anaconda Works, Salford, have taken over from the Phosphor Bronze Co., Ltd., of London and Birmingham, the manufacture of silicium bronze wire bars, and all classes of silicium bronze wire for telephone lines and for other purposes, also strip and tape in all widths to 3 in. Messrs. Smith take over the exclusive right to manufacture the above under their special processes, and also to make exclusive use of the "Cog Wheel Brand" in connection therewith, the Phosphor Bronze Co., Ltd., having entirely discontinued the manufacture of silicium bronze wire and wire bars.

Mr. E. Brook, electrical engineer, has removed from 3, Commercial Crescent, to Threadneedle Street, Huddersfield.

Messrs. Morrison & Roebuck have commenced business at 4, Birley Street, Blackpool, as electrical engineers.

The business of the Phillips Machine Syndicate, Ltd., will, in future, be carried on under the title and style of Phillips Commutator Grinder Co., Ltd.

Messrs. Featherstone Smith & Sons, of 67, Leadenhall Street, E.C., have been appointed wholesale selling agents, exporters and shippers, to Cryselco, Ltd., makers of the "Cryselco" incandescent lamps.

Electrical Timing Gear for Automobiles.—On the occasion of some hill-climbing trials of automobiles near Harrogate last week, there was brought into use for the first time Mr. F. J. Borland's electrical timing gear. The contrivance was applied with successful results. The breaking of the thread at the starting point liberates a lever which, through electrical communication, sets going a stop-watch at the other end of the course, and, in like manner, when the rider snaps the thread on passing the finishing post, the watch is immediately stopped, and the time can thus be taken to the fifth of a second.

Annual Outing.—The employés of the electrical department of Messrs. Bruce Peebles & Co., Ltd., East Pilton, held their annual picnic at Lanark last Saturday week. About 250 travelled by special train. Dinner was served in two large marquees at the Lake Pavilion, and was presided over by Mr. W. C. Peebles. The afternoon was spent in boating on the lake, golf, shooting, &c. After tea a concert and dance were held.

Ironmongery and Electrical Trades Exhibition.—The fifth annual Exhibition and Market of the Ironmongery, Hardware, and Electrical Trades is to be opened on 12th inst. at the Agricultural Hall, Islington. The show will close on July 22nd.

Bankruptcy Proceedings.—At the Croydon Bankruptcy Court last week, William Wenham, an electrical engineer of Croydon, came up for public examination. The liabilities were stated to be £574, the assets £129, and the deficiency £445. The cause of failure was set down as want of business experience, insufficient trade, and working expenses and cost of living during the time he had no income. The further examination was adjourned.

A receiving order has been made, on debtors' own petition, against F. W. Parkes & E. Sadleir (Parkes & Sadleir, electrical fitters and engineers, Colwyn Bay).

Dissolutions and Liquidations.—On June 15th the Court ordered that the following gentlemen act as a committee of inspection with the Official Receiver and Liquidator of the Automatic Telephone Co. (1903), Ltd.:—A. J. Crane, G. A. Paul, J. White, C. G. Penney, and J. D. Gibbs.

Messrs. J. H. Edwards, F. and W. D. Armstrong, and A. L. Stephens (Edwards & Armstrong, electrical and mechanical engineers, Bristol, Cardiff, and elsewhere) have dissolved partnership. Messrs. Edwards & Stephens will attend to debts, and will continue the business under the old name.

Messrs. G. E. Mansfield, and W. G. Dexter (Mansfield & Dexter, electrical engineers, Leicester) have dissolved partnership. Mr. Mansfield will attend to debts, and carry on the business.

Messrs. T. Usher and Wm. Schmahl (Armorduct Improved Electric Conduit Co., Farringdon Avenue, E.C., and Newcastle) have dissolved partnership. Debts will be attended to by Mr. Schmahl.

A meeting of the Dover Electricity Supply Co. is to be held at the Burlington Hotel, Dover, on August 3rd, to hear an account of the winding-up from the liquidators, Sir W. H. Crundall and Mr. R. Percy Sellon.

Sentence.—For obtaining electric cable under false pretences from several cable manufacturers, Arthur Britch (29), an electrician, was sentenced to nine months' hard labour at the Preston Quarter Sessions.

Bradford Exhibition.—Messrs. David Sowden & Sons, of Shipley, are exhibiting their various designs of tramway, feeder and electric light pillars, also jointing, service, fuse and other boxes, at the Bradford show, which remains open until October next.

LIGHTING AND POWER NOTES.

Aston Manor.—A meeting of local consumers was held on the 27th ult. in regard to the dispute about the charges for energy. Mr. W. H. Whitehouse was appointed to examine the meters on behalf of the consumers. A resolution was passed giving the Council three alternatives, viz.: the consumers would accept the terms of their accounts less 40 per cent.; they would be willing to pay the price of their gas bills with 10 per cent. or 20 per cent. added as thought advisable; or to have their meters tested by their expert and to pay on his advice. An amendment to pay on the state of the meters at the rate of 2½d. per unit was put forward, but lost.

The borough treasurer and the electrical engineer have interviewed 73 consumers and received objections from 10. In 31 cases definite settlements were arrived at by making allowances amounting to £24 10s. 6d., but in 24 cases the allowances, amounting to £22 18s. 8d., were declined.

Bridlington.—The prices for the supply of energy, when the generating station is completed, have been fixed at 5d. per unit for lighting and 3d. for power.

Buckingham.—The T.C. has accepted the tender of the local E.L. Co. for public lighting.

Burslem.—The T.C., on June 30th, decided to apply for a prov. order enabling the Corporation to supply energy within the area of Tunstall U.D.C.

Chertsey.—The U.D.C. has received intimation from the Woking Electric Supply Co., that it intends applying to the B. of T. for an extension of its prov. order for supplying energy in the rest of the district, which includes the towns of Addlestone and Chertsey, and the R.D.C. is informed that the same company intends to apply for an extension of its prov. order to supply energy in the parishes of Byfleet, Pyrford, Chobham and Bisley.

Coventry.—A L.G.B. inquiry was held on the 5th inst. into the application of the City Council for sanction to borrow £31,575 for the extension of its electricity works. The town clerk said that the undertaking was commenced in 1895, and made a loss for several years. Three years ago Mr. Jeckell, the present manager and electrical engineer, advised the Council that to put the department upon a sound financial basis it was necessary to double the capital expenditure, thereby increasing the earning capacity of the works threefold. There was an application about that time for a loan of £23,000, and in succession there had been other borrow-

ings of £19,411, £2,000, and £5,000, the last two being for motors, the supplying of energy for which was a new business to the Council. The present application was practically a completion of the decision of 1901 to double the capital of £75,000, mainly on account of the demand for a larger supply of energy for motors. It was found that the demand for lighting had not been as large as expected, in comparison with other towns of the same size. In 1901 the number of 8-C.P. lamps connected was 22,737, and in 1904, 33,526, whereas for the corresponding periods the increase in the demand for power was: 1901, 30 H.P.; 1904 (March), 674 H.P. Since March, 89 H.P. had been connected, and applications for a further 70 H.P. had been made. The change of policy of the department had converted a losing concern into a successful one. The electrical engineer's evidence showed that the amount for which sanction was asked would be devoted to the following works: Mains, £12,000; new sub-stations, fitted complete with all apparatus, £200; transformers, £3,000; services to consumers with meters, &c., £3,000; new generating plant (600 KW. two-phase), £6,725; boiler, £1,150; crane, £450; buildings, £1,500; foundation, £250; feed pumps, £250; pipes, £500; coal conveyor (extension), £300; economiser (extension), £300; motors for works, £150—total, £31,575.

Crewe.—The T.C. has resolved, on the recommendation of its E.L. Committee, to apply to the L.G.B. for sanction to borrow £4,000 for plant extensions at the electricity works.

Dorking.—Edmundson's Electricity Corporation, Ltd., has offered to the U.D.C. terms for public lighting by electricity. Its offers to erect 80 ½-amp. and 158 ¼-amp. Nernst lamps, at a cost of £583 16s. per annum, in addition to £187 interest and sinking fund charges on capital outlay. An alternative scheme provides for 16 arc lamps, with two ½-amp. Nernst lamps on each post, 48 ½-amp. lamps, and 158 ¼-amp. lamps, at an annual cost of £675. In view of the competition, the Gas Co. has reduced its tender by £100 on last year's figures.

Dudley.—The Electrical Committee of the Corporation has recommended that the offer of a 400-KW. set by Messrs. Ferranti at £2,200 installed be accepted, and that the charge to consumers of power be reduced to 1d. per unit for 22 hours, and 6d. for the two hours of heavy load.

India.—The *Bombay Gazette* states that the electrical installation at Fort William has been completed.

Gloucester.—The electrical engineer recently submitted to the Electricity Supply Committee a report on the capacity of the existing lighting plant, and pointed out that as next winter's load would probably be equal to the full working capacity of the existing plant, the Committee should without delay arrange for the installation of the additional plant which would be required at the end of the year 1905.

Gravesend.—Without waiting for the result of the conference with Northfleet U.D.C., the T.C. has decided to apply for a prov. order extending the area of supply to Rosherville, which is included in the parish of Northfleet.

Italy.—A concession has been applied for by the Reggio Calabria municipal authorities to put down a plant to utilise the water power of the St. Agata River for generating energy for lighting the town by electricity.

Kingston-on-Thames.—The L.G.B. has sanctioned a loan to the T.C. of £15,850 for E.L. purposes.

Llantrisant.—The U.D.C. has resolved to apply to the L.G.B. for a prov. order to light the parishes of Tonyrefail and Gilfach Goch by electricity.

London.—ISLINGTON.—The electrical engineer has reported that the low-pressure pistons of the three 1,000-H.P. engines have worn to a certain extent, and allow steam leakage, and on his suggestion it has been decided to fix tail rods on the ends of the pistons to prevent this, at a total cost of about £300.

WANDSWORTH.—The County of London Electric Supply Co. has decided to introduce an alternative flat rate of 6d. per unit for lighting. The maximum demand rates will remain the same, but the charges for meter rents are to be reduced by about 25 per cent.

SHOREDITCH.—The accounts of the electricity undertaking for the year ending March 25th last show a surplus of £1,044, after debiting the electricity account with the whole of the cost of the destructor, less the charge to the general rate of 2s. per ton for refuse destroyed, and also paying loan charges amounting to £13,461. The sales increased during the 12 months by nearly 9 per cent., the total costs less than 4 per cent. £1,000 of the surplus was carried to reserve.

HAMMERSMITH.—The B.C. has decided, in regard to the tenders for supplying the additional plant in connection with the extension of the electric lighting installation, that the work be divided between Messrs. Richardsons, Westgarth & Co. and the British Thomson-Houston Co. The total cost is £14,936 2s. 10d.

L.C.C.—Upon the recommendation of the Finance Committee, the L.C.C. has agreed to lend the Fulham B.C. £25,000 for electricity purposes, and the Hampstead B.C. £4,300 for electricity meters.

MARYLEBONE.—The Finance Committee of the B.C. reported on Tuesday last that, owing to certain technical difficulties, it had been unable to complete the purchase of the electric lighting undertaking, as expected, on June 30th. An undertaking had been given that the seal would be affixed to the form agreed upon by counsel for the municipality.

DEPTFORD.—The L.C.C., in a circular letter to the B.C., stated that application to Parliament in the Session of 1905 for powers to enable local authorities in London to wire and fit consumers' premises for the use of electrical energy, and to obtain loans for such purpose, could only be proceeded with upon the understanding that the Metropolitan Borough Councils concerned would give the fullest possible support.

Mirfield.—An agreement for the supply of electricity in bulk has been entered into between the U.D.C. and the Yorkshire Electric Power Co., whose first generating station at Thornhill will shortly be completed. The Council proposes to undertake only the distribution of energy for lighting purposes, and to leave the supply of energy to power users, such as mills, collieries, &c., to the company. Mr. A. B. Mountain, of Huddersfield, has acted as the Council's consulting engineer, and the company's engineer, Mr. W. B. Woodhouse, states that a supply will be available in December next.

Neath.—A L.G.B. inquiry was held on the 29th ult. into the application of the Corporation to borrow £5,000 for electric lighting purposes. It was explained that the Council had obtained a prov. order in 1901 and had entered into an agreement with the South Wales Electrical Power Distribution Co., which will be in a position to supply energy in September.

Newton Abbot.—The official opening of the electricity works was performed recently by Mr. H. T. Parker, chairman of the Lighting Committee of the U.D.C.

Rickmansworth.—The B. of T. has revoked the 1901 electric lighting order.

Stockton Heath.—The parish meeting has approved of the offer of the Warrington T.C. to seek powers to supply energy to the parish at the same prices as charged to consumers in the borough.

Sydney, N.S.W.—The E.L. Committee of the City Council visited the new power house at Pyrmont on May 20th; it was expected that the building would be finished in the course of a month, and the resident engineer, Mr. T. Rooke, hoped to have the machinery running and the light switched on by about July 1st.

Uxbridge Road.—The L.U.T. Co. are fixing electric lamps to the standards along their system between Southall and Uxbridge.

West Bromwich.—The Electricity Committee states that the price of energy charged, viz., 1d. per unit in the case of motor installations of 3 H.P. and under, is not sufficient to cover sinking fund and interest on the average cost of a service, and recommends that for such installations consumers shall be given the option of an increase of ½d. per unit, or pay for a minimum consumption of 200 units per H.P. per quarter. Also, in cases where light and power are used, that energy for power purposes be registered by the lighting meter, the indicator being placed in the lighting circuit only, so that all energy used for power will be charged for at 1½d. Mains extension to the Spon Lane district, and application to the L.G.B. for sanction to borrow £1,300 for this purpose are also recommended. Sanction has been already received to loans of £1,751, £548, and £1,000 for extensions, street lighting, and other necessary improvements.

West Hartlepool.—Mr. H. F. Friederichs, the Corporation electrical engineer, has issued two small pamphlets entitled "Electricity for Lighting Purposes," and "Electricity as a Motive Power." These were prepared for the purpose of enlightening those ratepayers who may be prejudiced against electricity through statements given in the pamphlets distributed by the local gas company. The booklets explain fully and simply the many advantages to be derived from the use of electricity, both for lighting and power, and with such low prices as obtain at Hartlepool, we hope Mr. Friederichs's efforts may lead to the enlightenment, in more senses than one, of the unbelievers. Pamphlets identical with these being distributed by the gas company in the above town are being circulated all over the country by the various gas authorities; and Mr. Friederichs states that if any station engineer would like copies of his electrical pamphlets, they are to be had for the asking, and the contents may be altered to suit local conditions for use in other places, if helpful to the cause of publication.

Western Australia.—The Associated Gold Mines of Western Australia, Ltd., recently erected a 20-stamp mill, worked by electricity, for the purpose of treating ore of a lower grade than could be worked at a profit by the present method. Should the result prove satisfactory, it is intended to increase considerably the number of stamps.

Wrexham.—The L.G.B. has given sanction to the T.C. to borrow £5,600 for extending the E.L. cables and providing new plant.

TRAMWAY AND RAILWAY NOTES.

Bournemouth.—The arbitration proceedings respecting the Poole and district electric tramways were continued last week, but as the Umpire will be engaged as Commissioner of Assize until August 12th, the date of the resumption of the proceedings was not settled.

East Ham.—The Finance Committee of the U.D.C. have been asked to consider the question of finding the necessary funds for the duplication of the single tracks from the Beckton level crossing to the terminus at Cyprus Place, and from Halley Road to the Romford Road.

Falkirk.—A correspondent says that there is every prospect of the constructional work of the Falkirk and district electric tramways being proceeded with immediately.

Folkestone.—The B. of T. has granted the T.C. an extension of time to August, 1906, in which to construct the proposed electric tramways.

Halifax.—The T.C. has decided to commence forthwith the construction of electric tramways from Brighouse to Bailiff Bridge—about one mile in length—at an estimated cost of £12,746 5s. A correspondent says:—"One of the chief reasons for constructing the line is to obviate the necessity of objecting to the granting of running powers through Brighouse between Huddersfield and Bradford."

Harrow and Uxbridge Railway.—The Harrow and Uxbridge Railway which was formally opened on June 30th, from its junction with the Metropolitan, half a mile west of Harrow Station, to Uxbridge, is six miles long, and the branch which connects it with the District Railway at South Harrow being a mile long, the total mileage is about seven miles. The line is completely equipped for electric traction on the same system as is to be used on the District and Metropolitan underground lines, but pending the completion of a transformer station near Ruislip, the only intermediate station between Harrow and Uxbridge, and the general introduction of electric traction on the Metropolitan, steam power will be used.

Heywood.—The T.C. has applied to the B. of T. for an extension of time from August 8th, 1905, to August 8th, 1906, in which to complete the electric tramways.

Liverpool.—At the last meeting of the Tramways Committee, Mr. T. Utley moved that a resolution passed by the staff sub-committee in 1899, fixing 5 ft. 6 in. as a minimum standard of height for applicants who wished to become drivers or conductors of the electric cars, be rescinded. Five councillors voted for the motion and five against. The chairman then gave a casting vote against the motion, which was accordingly lost.

London.—Wandsworth.—The Highways Committee of the L.C.C. has informed the B.C. that it has considered the representations made by a recent deputation asking that the tramways schemes (*a*) from Clapham Common to East Hill, Wandsworth, and (*b*) from the Streatham terminus to the county boundary, be revived. The schemes could not be submitted to Parliament before 1906, and in the meantime any proposals concerning same or the construction of other lines would receive attention.

North London.—The Highway Committee of the L.C.C. has convened a conference of representatives of metropolitan borough councils north of the Thames for the 14th inst. to consider the system of traction to be adopted on various tramway routes in which there are serious difficulties in the way of the use of the conduit system.

L.C.C.—At Tuesday's meeting the Highways Committee reported that the tramway accounts had now been made up for the year ended March 31st, 1904. The accounts show, for the southern lines, total receipts amounting to £536,239, as against working expenses of £441,786, thus leaving a gross revenue of £94,453. As, however, debt charges, amounting to £100,536 for interest and sinking fund, and a charge of £2,200 for income-tax, have to be set against the gross revenue, the final result of the year is a deficiency of £8,283 to be carried to the appropriation account. The deficiency is attributed mainly to the loss of receipts from the dislocation of traffic during the reconstruction of parts of the tramways for electric traction, and to the lines not being worked by electric power by the estimated dates. In the case of the lines leased to the North Metropolitan Tramways Co., the account shows a surplus or net profit of £27,657.

Marylebone.—The Legal and Parliamentary Committee of the B.C. reported on Tuesday that they could not approve of the plans submitted by the Metropolitan Railway Co. for an electrical substation in Upper Baker Street.

Nottingham.—The City Council on Monday decided to seek Parliamentary powers to carry out a further large extension of the electric tramway system, which is estimated to cost £110,000.

Old Hill and Blackheath.—Upwards of £28,000 is being expended at the present time in connection with the construction of tramways in the Old Hill and Blackheath districts, and it is hoped that they will be completed by the autumn.

Preston.—Electric trams commenced running on the Fylde Road route on June 30th.

Spain.—The Medina, Zamora, Orense, Vigo Railway Co. proposes to adopt electricity in place of steam traction on its lines. Application has been made for a concession to utilise the water power of the Rivers Bubal, Cape, and Sil. A large central station is to be established at Los Peares.

Tipton.—At the last meeting of the U.D.C., letters which had passed between the B.E.T. Co. and the B. of T. and other authorities in reference to the stoppage of the trams on the Wednesbury-Tipton-Dudley lines, were read. The company stated that after what had been said at the recent conference of authorities at the B. of T., they were reluctantly compelled to stop the present service. The B. of T., when asked to compel the company to carry out their agreement to electrify the line, referred the Council to a letter in which the directors stated that their engineer's report showed the road was so disturbed with mining operations, that electrification for the present was out of the question. The clerks to the various authorities, it was also stated, had sent a joint letter to the company, who invited a deputation to a conference at Birmingham on July 7th. Mr. W. W. Doughty contended that the company had for some time been looking for an excuse to stop the cars. As a Council they neither wanted interviews with the tram company nor the B. of T., but a law suit, and the sooner they set about it the sooner the trams would be running again. Personally, he had no confidence in the company, and if they ever had to enter into another agreement with the company, they must see to it that they had a heavier penalty inserted in such agreement. He proposed that an invitation be sent to the Dudley and Wednesbury authorities to take joint action in the matter. This was seconded by Mr. Robins, and carried; and it was also decided to ask the Coseley U.D.C. to co-operate with the other authorities concerned. The Chairman asserted that there was no obstacle to the electrical equipment of the line from Dudley to Princes End.

Westinghouse Automatic Signalling.—A year ago the inauguration of the Westinghouse automatic signal system on the Ealing and Harrow branch of the Metropolitan District Railway took place, and now the whole of this railway is being so equipped. A week or so ago four track circuits worked on the same principle were brought into use at the Highbury Station of the Great Northern and City Railway. These track circuits govern two "home" signals, and a "starting" signal in either direction, *i.e.*, six signals in all, the two home signals working simultaneously. Highbury Station is a new one and was brought into use the same day as the signals. This installation is interesting as being the first application of the Westinghouse automatic signals on a London tube railway. The Westinghouse Brake Co., Ltd., of King's Cross, N., were responsible for the work.

Mexican Rubber.—The following are some extracts quoted by the *Financial Times*, from a report just made by the United States Vice-Consul-General at Mexico City:—

"Probably more letters of inquiry are received at this Consulate on the subject of rubber culture in Mexico than upon any other single subject. In spite of repeated warnings from a great variety of sources, school teachers, preachers, and other persons working for small salaries in the United States, continue to invest their savings in rubber companies about which they know nothing. The desire to invest in a mine or rubber plantation, usually mythical, or some other alluring scheme in some far-away country, seems to be an evidence of the gambling instinct inherent in every individual. The man or woman working for a small salary seems to think that his or her only chance to get rich is by some lucky investment which will pay fabulous dividends, and the wilder the scheme presented, the more anxious he or she is to invest money in it. A number of Americans have, to my own knowledge, purchased stock in fake rubber plantation companies, after having been warned by reliable persons against such investment. A number of other Americans have made trips to the tropics of Mexico, been wined and dined by plantation managers, and shown a few rubber trees, and become easily satisfied that they know all about rubber culture. Afterwards they have asked the opinion of old residents of that section on the subject, and gone away pitying them for their dense ignorance, because they were unable to see the immense fortunes to be made in rubber.

"Theoretically, rubber culture is a very alluring proposition, but thus far, it has never yielded any practical results. It was experimented with for years in other countries before its cultivation was undertaken in Mexico, and, according to a recent report of the United States Department of Agriculture, the experiments have always been failures. There is as yet no good reason to believe that its cultivation in Mexico will prove any more successful than it has in other countries. The recommendation of this report, that farmers in tropical countries might profitably plant various species of rubber trees on otherwise unoccupied spots of land, purely as experiments, is most reasonable. After such experiments have been made, involving no great expense, the tropical agriculturist may discover how to grow rubber successfully upon his particular piece of land, and may then attempt to make a crop of it."

L.C.C. TRAMWAYS: THE BRIXTON AND STREATHAM LINE.

The following brief account of the conversion to electrical working of the old cable tramways between Kennington Gate and Streatham will probably be of interest to our readers. We give also some views of the work in progress, in addition to those published in our issue of June 17th:—

Tearing up the Old Cable Track.

Trench Ready for Yokes.

On March 2nd this year, the London County Council officially notified Messrs. J. G. White & Co., Ltd., that they had been awarded the contract for the conversion of the Streatham line of cable tramways to the conduit system of electric traction. In view of the importance of this thoroughfare, it was stipulated that the work must be finished by July 1st. When one considers the difficulty of tearing up 18,000 ft. of double cable line which has been well laid, and also allows for the inevitable delays in delivery of material, and the short notice given, it will be conceded that the task of completion within the specified time was one calling for wide experience and first-class organisation.

Mr. I. Fisher, who had already constructed some 30 miles of conduit in South London for Messrs. J. G. White & Co., broke ground on April 6th. For the breaking-up of the old cable road some interesting devices were adopted by Mr. Fisher. In lifting the wheel rail, Barrett jacks were used as on the first Tooting track, but in order to save time in starting the operation a jaw was fitted around the head of the rail, and this jaw was raised by two jacks mounted on iron wheels. In this manner the necessity of breaking up the roadway at each

Yokes in Position.

Bonding Conductor Rails.

fresh start was obviated. In order to avoid the tedious process of unbolting the slot-rail from the yokes, wedges of varying thickness were driven into the slot, whereby the slot-rails were forced apart, carrying the shoulders of the yoke with them. The concrete enclosing the old cable tube was found to be very hard and difficult to remove, but after the first 10 days it was discovered that by driving the wedges (four men to a wedge) a certain distance back on either side of the tube a seam was opened up. The finding of this seam enabled the concrete to be taken out in large blocks.

During the first week the number of men employed was increased daily until some 1,600 men were at work, and such progress had been made that on May 18th, a car was run over the double line from Kennington Gate to Water Lane, a distance of $1\frac{3}{4}$ miles. On this section the roadway under the Brixton Railway Bridge was lowered 8 in. from building line to building line. The Board of Trade inspection took place on May 20th, five weeks before time.

It is interesting to note that two weeks before commencing work, a schedule of daily progress was made out in which the date for the completion of tearing-up was given as June 2nd. This part of the work was actually finished on that date; the average of progress by all the gangs was 1,000 ft. of single track per day. Considering the character of the work in taking out the old cable line and constructing the new conduits, it must be admitted that this is a record in conduit tramway construction.

The work was completed on June 13th, and the first car ran to the terminus on the 15th. The Board of Trade inspection was held on June 18th, and the line was thrown open for traffic on June 19th, 17 days ahead of the stipulated date.

There can be no doubt that could the manufacturers have delivered material earlier, the whole work would have been completed by June 1st. The celerity with which the work was carried out allayed the fears of the frontagers and road authorities as to the friction and inconveniences usually associated with work of this magnitude.

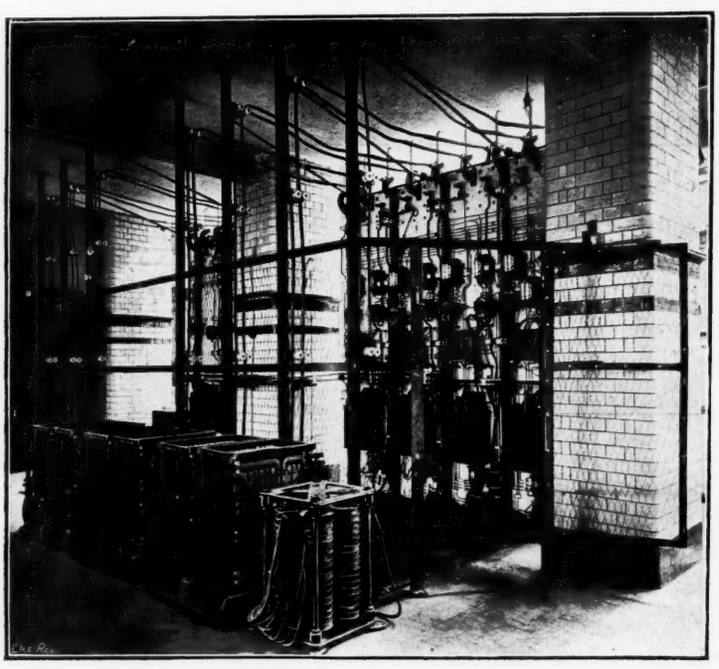
Mr. Maurice Fitzmaurice, chief engineer to the Council, made several alterations in the construction of the track as compared with the first Tooting line. The rail length was increased from 30 ft. to 45 ft. On the Tooting line the rails were laid with "Dicker" joints without any provision for anchoring, but on this road anchored rail joints were used; the rails were also anchored between joints. The position of the sumps was changed from the margin to the centre of the track, and the sumps were spaced 140 ft. apart instead of 180 ft. as formerly. The conduit tubes discharge directly into the sumps; the difficulties found in keeping clear the pipe connections from tubes to sumps are thus avoided. At insulator pockets paving plates were inserted, carried between yoke and stirrup support in panel. For slot switches in the special work Hadfield's design was adopted. The castings were supplied by the Anderston Foundry Co., Ltd., the tie rods by Messrs. Bayliss, Jones & Bayliss, Ltd., and the cement by the Associated Portland Cement Manufacturers, Ltd.

The whole of the work was executed under the supervision of Mr. A. N. Connett, chief engineer to the contractors.

EXETER'S NEW ELECTRICITY WORKS.

Like its neighbour Taunton, Exeter was one of the very first towns in the kingdom to go in for a public supply of electricity, this having been started some 15 years ago (*i.e.*, in 1889) by the Exeter Electric Lighting Co., which consisted mainly of local residents. In 1896 the Corporation took over the system, which had been extended from time to time; and in 1901 still further extensions were decided upon, these involving the erection of a new generating station in a more convenient position by the River Exe.

The supply has hitherto been on the high pressure single-phase system, with Thomson-Houston series arc-lighting dynamos for the supply of the street lamps. The new plant is two-phase, the growing requirements for power, and the probable adoption of electric traction, rendering a continuation of the old single-phase generating system inadvisable. Two-phase working was adopted in preference to three-phase because it involved the least amount of alteration to the existing mains.



Exeter Electricity Works: Back of Switchboard.

The plans and specifications for the generating station and its equipment were prepared by Mr. H. D. Munro, the city electrical engineer, who had charge of the work from its inception to the completion. The change from the single to the two-phase system was effected without any interruption of the supply of current to consumers.

The British Westinghouse Electric and Manufacturing Co., of Trafford Park Works, Manchester, obtained the contract for the complete equipment of the new power house, the laying of the new high pressure mains being entrusted to Messrs. Siemens Bros. & Co.

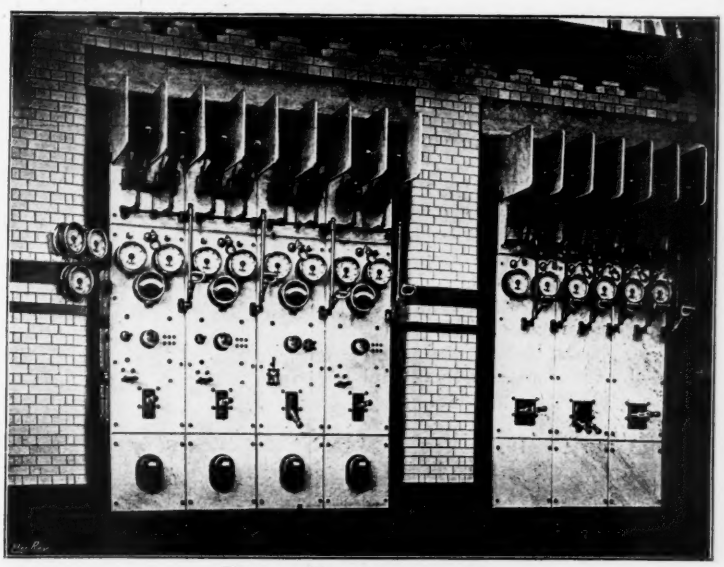
The buildings at present erected cover an area about 150 ft. square, and considerable space has been allowed for future extensions. They are divided into three bays which form the boiler house, the engine and generator room and the offices respectively; the economisers, boiler-feed pumps, &c., are situated in annexes. The shaft is a handsome octagonal structure of brick, and is 155 ft. high, with an internal diameter of 8 ft. 6 in. The boiler house is a lofty building 102 ft. long and 55 ft. wide; the engine room is of the same length, but 10 ft. less in width. The floor is of terazzo mosaic paving to ensure the utmost cleanliness, and galleries give access to the switchboard as well as to the boiler house and the various offices.

The system of handling the fuel is very complete. The coal is put into shoots which deliver it to the automatic filler of the gravity bucket coal conveyor, which is electrically driven by a Westinghouse two-phase induction motor. This conveys the fuel to one or other of a series of bunkers having a capacity of about 500 tons. The conveyor can deal with 30 tons of coal per hour. From the bunkers the coal is discharged in measured quantities into the hoppers of

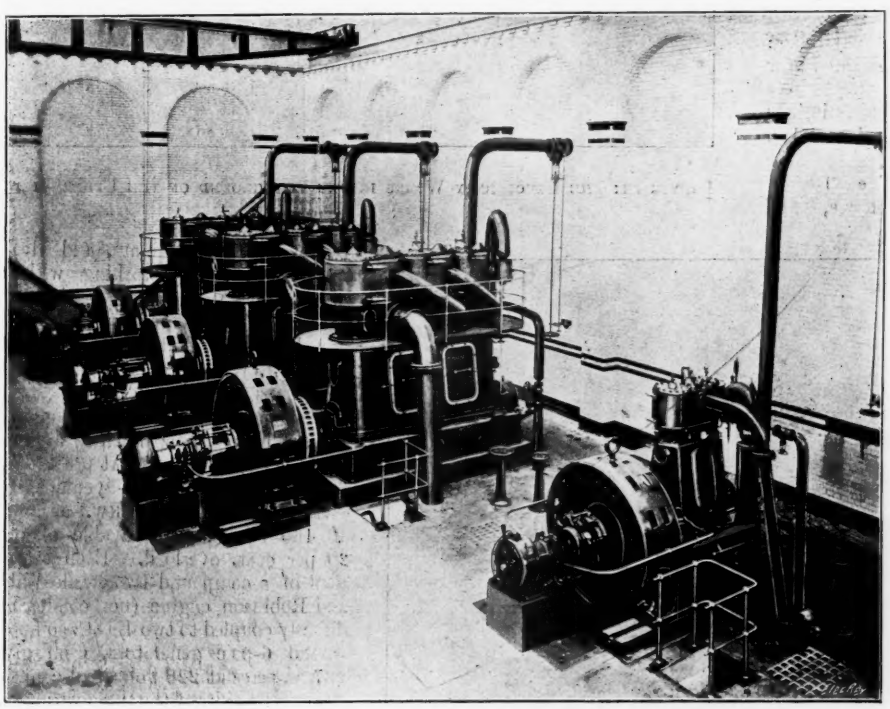
the chain-grate mechanical stokers. The latter are also electrically driven, and besides carrying the coal into the fires, discharge the ashes and clinker into the basement below the boilers, whence the same conveyor removes them to the ash bunker. A railway siding, at present under construction, will complete the fuel and ash-handling arrangements. The boiler house plant consists, at present, of three new Babcock & Wilcox boilers, each with a heating surface of 4,020 sq. ft., and fitted with superheaters. Eventually four of the boilers in the old station, which are of the same type, will be brought over to the new station, and the total capacity will then be 2,700 H.P. A steam-pipe ring on the boiler house wall carries the steam into the adjacent engine room, this being so arranged that any boiler or engine can be isolated if necessary. The main steam piping is 10 in. in internal diameter with branches 7 in. in diameter, the steam stop-valves being of the Hopkinson parallel-slide pattern.

The new boilers are each capable of evaporating 13,000 lbs. of water per hour at a pressure of 150 lbs. per sq. in., with Welsh coal, hand firing, and natural draught. They are, however, as stated above, fitted with chain grate mechanical stokers.

Two of the three feed pumps are steam driven, and one electrically-driven. The former are of the Worthington direct-acting type, and are each capable of delivering 2,500 gallons per hour, against a boiler pressure of 150 lbs. The electrically-driven pump is of the Worthington three-throw plunger pattern, and has a capacity of 3,900 gallons per hour, its motor, a two-phase two-speed Westinghouse induction machine, taking 60-cycle current at either 220 or 400 volts. The two Green economisers each consist of 320 tubes, with scrapers of the latest pattern, driven by a steam engine.



EXETER: MAIN SWITCHBOARD.



EXETER: GENERATING PLANT.

The engine-room plant at present comprises four Westinghouse two-phase generators direct-coupled to Belliss and Morcom engines, three being of 400 KW. and one of 100 KW. capacity—a total of 1,300 KW. The large sets run at 360 r.p.m., and the small one at 514 r.p.m.; the pressure is 2,200 volts, and the frequency 60. Steam is supplied at 145 lbs. pressure, and each engine is connected with a Worthington jet condenser. Each set is capable of dealing with one-hour overloads of 25 per cent. The exciters are direct coupled, and are of the Westinghouse multipolar type. The engine room is traversed by a 10-ton hand-power travelling crane, supplied by Messrs. C. & A. Musker, the span being 44 ft. and the lift 18 ft.

The controlling arrangements consist of a combined high and low pressure switchboard for connecting the four generators with the six supply circuits, each generator circuit including an integrating wattmeter. The panels of the high pressure board are of marble, and provision is made for the addition of extra ones at any future time. Each alternator and feeder panel is equipped with switches, circuit-breakers, ammeters, &c., of the latest Westinghouse patterns, the alternator panels being also fitted with Westinghouse synchronising gear. Three station voltmeters, with switches and transformers, calibrated up to 2,200 volts, are fitted. Arrangements are made to enable any generator or circuit to be isolated from the main bus-bars and switched on to "hospital bars" for independent working. Front and back views of the switchboard are given herewith.

The whole of the work has been carried out on the most modern lines, the lay-out of the buildings and plant being such as to allow future extensions to be made from time to time. Only one-fourth of the available ground area is at present occupied, so that the further increase of the lighting load, the development of the motor load, and the advent of the extensive system of electric tramways that is foreshadowed, will not be difficult to cope with.

ELECTRIC LIGHTING OF LADYSMITH (NATAL).

[From our Durban Correspondent.]

Ladysmith, like many other towns in South Africa, has shown its ambition to be "up to date," by installing a municipal electric lighting plant, which has been in successful operation for the past eight months.

Being at one time merely a garrison town, and centre for Northern Natal, it was but little known to the electrical world; but such cannot be said of it now. Its population at the last returns was 2,273 white, and 3,048 coloured. The specifications for the complete electrical plant were drawn up by Mr. J. Roberts, borough electrical engineer of Durban, and 12 tenders were submitted to the Council. The lowest was that of Messrs. Hubert Davies and Spain, of Johannesburg, Pretoria, and Durban, amounting to £8,382, which was accepted, and came very near the estimated cost of £8,240.

The work was at once put in hand, Mr. J. Stanley White being appointed borough electrical engineer, and Mr. Roberts retained as consulting engineer; the erection of the installation was carried out under the personal supervision of Mr. F. Margrie, the Durban manager for Messrs. Hubert Davies and Spain.

The power station buildings were erected by Mr. A. Fraser, of Ladysmith, according to plans prepared by Messrs. Ritchie and Galliers, of Durban. The buildings are of wood and iron, and consist of boiler and engine room, with test room, office and quarters adjoining; the station is conveniently situated near the centre of the supply.

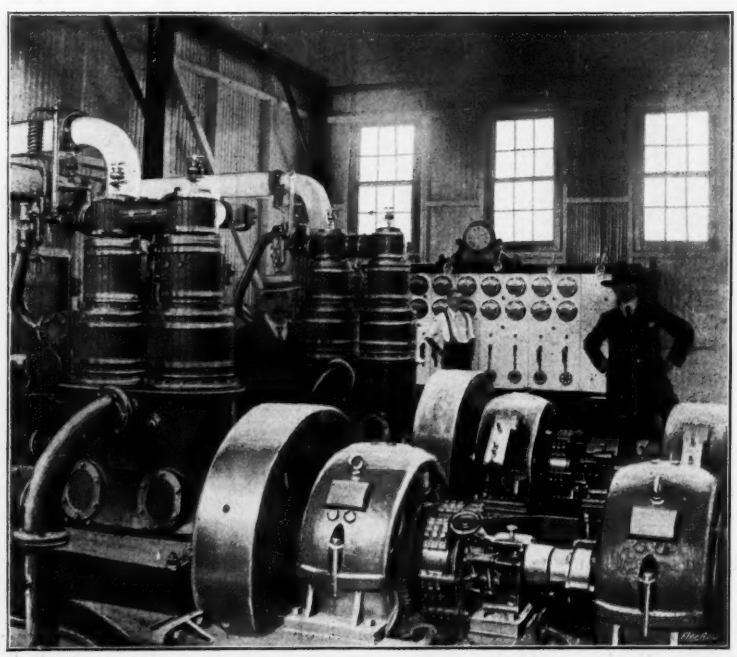
A general view of the buildings is shown in our illustration taken from Convent Hill overlooking the Market Square, with the famous Wagon Hill in the distance, and another view shows the town, with Umbulwana on the right.

The boiler room is 40 ft. long, 35 ft. 6 in. wide, and at present there are installed three Robey boilers of the semi-fixed loco-type, each capable of evaporating 2,475 lbs. of water per hour at 145 lbs. steam pressure, the fire-boxes being of special design to suit Natal coal.

A raised tank is supplied with water from the town mains, and delivers water under a small head to the feed pumps, &c.

The feed water is delivered to the boilers by a compound

Ladysmith: The Electricity Works in the Foreground of the Upper View.



Ladysmith Electricity Works: Interior of Engine Room.

double ram Pearn pump, and also by a Sirius injector working with the exhaust steam from the engines, and live steam from the boilers.

A large exhaust steam feed heater by Messrs. J. Wright & Co. is used between the pumps and the boilers.

The engine room is 40 ft. long, 27 ft. 2 in. wide, and is spanned by a two-ton travelling hand crane. At present there are two sets of steam-dynamos, each giving an output of 50 kw., at a speed of 460 r.p.m., and capable of doing 20 per cent. overload. Each set consists of a compound two-crank Willans and Robinson engine (non-condensing), directly coupled to two E.C.C. compound wound 6-pole generators, each giving 137 amperes at 220 volts, and connected to opposite sides of the three-wire system. These engines are very popular in Natal, Messrs. Hubert Davies & Spain holding the agency for the whole of South Africa. The tests were very satisfactory, the water consumed being 22 lbs. per horse-power-hour, and the combined efficiency 75·6 per cent.

A view of part of the engine room is shown, with the switchboard (by Messrs. Nalder & Co.) in the background.

The switchboard consists of two generator panels and six feeder panels of simple design, with room for extensions. The panels are of polished marble, and, in addition to the measuring and regulating apparatus, they carry only switches and fuses connected to the outer bus-bars, the middle bus-bar being earthed.

A subsidiary switchboard at the back controls the street lighting circuits.

The system of distribution adopted is a three-wire direct current supply, with 400 volts between the outers, and 200 volts on each side of the middle wire.

The mains are carried overhead on 30-ft. iron poles, placed about 40 yards apart, and are mostly of No. 6 S.W.G. bare copper, except in the principal street, where 19/17 is used. There are six circuits leading to the various parts of the town; the streets being broad and straight, lend themselves very well to overhead supply, and the houses being scattered, the outlay for underground mains would have been prohibitive.

The two outer wires are carried on porcelain insulators fixed to wooden cross arms, whilst the middle wire is bound to a special clamp on the pole itself, well above the outers; it is thus "earthed" at every pole, and is useful as a lightning guard, as well as a guard against other falling wires. Lightning arresters of the "Wurtz" type are fixed at all terminal poles, as well as where the mains enter the station. The total length of pole line, including the street lighting, is about 13 miles.

The street lighting is effected by 160 incandescent lamps of 32 C.P., carried by strong brackets fixed to every alternate pole. There are also four Johnson & Phillips "Ark" lamps in the main street.

The connections to the houses are made by means of insulated wires, led direct on to the roofs from the nearest poles, a flying fuse being carried on the outer main. At present there are about 120 houses connected.

The charges for lighting are on a sliding scale from 1s. to 8d. per unit.

TELEGRAPH AND TELEPHONE NOTES.

Black Sea Cable.—The *Standard* correspondent at Odessa says that by purchase and under concessions from the Russian and Turkish Governments, the Black Sea cable between Odessa and Constantinople was to pass into the hands of the Indo-European Telegraph Co. on Friday last.

The Telegraph Conference.—Rates and regulations fixed at the last Telegraph Conference held in London came into force on 1st inst. The British administration has stated that, with the exception of a few who have not yet signified their approval, but of whose doing so ultimately there appears no doubt, all States have ratified them.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired
Dominica-Martinique	May 5, 1902	
St. Lucia-Martinique	May 7, 1902	
Trinidad-Demerara No. 1	Aug. 27, 1901	
Cayenne-Pinheiro	Aug. 18, 1902	
Anjer-Kalianda	Aug. 2, 1902	
Reissa-Issa (Yemen)-Camaran	Oct. 29, 1902	
Tarifa-Tangier	Jan. 18, 1904	
Closed { Nagasaki-Vladivostock	Feb. 15, 1904	
Closed { Port Arthur-Chefu	Feb. 18, 1904	
Foochow-Formosa	Feb. 11, 1904	
Accra-Lagos	June 1, 1904	June 23, 1904
Chio-Ténédos	June 21, 1904	
Landlines.		
Seoul-Masampo	Feb. 18, 1904	
Seoul-Gensan	Feb. 18, 1904	
Anju-Ping-Yang	Feb. 25, 1904	
Ninguta-Vladivostock	March 2, 1904	
Dominican lines	May 26, 1904	
Sa'gon-Bangkok	July 1, 1904	
Indo-European	July 2, 1904	July 2, 1904

Wireless Telegraphy.—The *St. James's Gazette* says that one of the main intentions of the amalgamation which has been effected between the De Forest and Maskelyne systems is the employment of wireless telegraphy as a feeder for the cables. In the course of an interview, Mr. Maskelyne said that in all cases in which it is difficult to lay or maintain cables, and also where land communication is rendered difficult by reason of the wires being blown down in exposed areas, wireless telegraphy is capable of supplying the link. There are thousands of islands, big and small, dotted over the ocean, with which it is difficult and often impossible to provide cable communication. For them wireless telegraphy is a necessity. "In co-operation with the cable companies we propose to link up these islands with the nearest cable stations. We also propose to develop wireless communication between ships and shore and between vessels at sea. In short, we aim at employing wireless telegraphy on practical lines." The United States Government, Mr. Maskelyne said, had recently investigated nearly every system of wireless telegraphy, spending $200,000 in conducting tests, and the De Forest system had come out on top. The De Forest system has been adopted by all the United States Government departments that use wireless telegraphy. The De Forest apparatus is a sound recorder, the messages being received on the principle of a telephone. The Maskelyne system, on the other hand, is a tape recorder, so that the amalgamation will combine the two methods and admit of either being used, according to requirements. Our contemporary adds:—"There are already rumours of threatened legal proceedings over the infringement of patents."

Another paper reports that the De Forest Wireless Telegraph Co. has brought a suit against the American Marconi Co. for £200,000, alleging that the Marconi Co. circulated false reports about the former's contract with the Navy Department for wireless stations in Florida, Cuba, Puerto Rico, and Panama. Another suit has also been entered against the Marconi Co. by a stockholder, who declares that the company has been grossly mismanaged and is insolvent.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aston Manor.—July 18th. Pipe-work for the electricity works. See "Official Notices" June 24th.

Batley.—July 16th. The Corporation invites tenders for a 350-KW. steam dynamo, and switchboard extensions. See "Official Notices" July 1st.

Belfast.—July 11th. Two portable electric gantry cranes for the Harbour Commissioners. See "Official Notices" July 1st.

Bristol.—July 15th. Switchgear, water-tube boilers, two 1,000-KW. three-phase extra high-tension turbo-alternators, two 500-KW. induction type motor-generators, cables and transformers, for the Corporation electricity department. See "Official Notices" July 1st.

Bulgaria.—August 13th. The Municipal Authorities of Phillippopolis are inviting tenders until August 13th for the concession for the electric lighting of the town and for the construction and working of an electric tramway.

Clyde.—July 25th. Two 32-ton electric coaling hoists for Clydebank Dock. See "Official Notices" June 17th.

Dartford.—July 19th. Mains extensions. See "Official Notices" July 1st.

Dublin.—July 9th. Tenders are invited for the supply of 100,000 pairs of arc lamp carbons to be delivered as required to the Electricity Department.

Dublin.—July 22nd. Machinery oils for 12 months. See "Official Notices" to-day.

Erith.—July 11th. Rails, fishplates and bolts; permanent way construction for the U.D.C. tramways. See "Official Notices" June 10th.

Felixstowe.—July 9th. Extensions to feeders. See "Official Notices" June 24th.

Fire Alarms.—July 15th. Tenders are invited for wiring several installations at York for the May-Oatway Fire Appliances, Ltd. See "Official Notices" to-day.

Halifax.—Offers are being invited by the Corporation for the supply of arc lamp carbons.

Handsworth.—July 11th. Water-tube boilers, engines and dynamos, crane, battery, arc lamps and posts, switchboard and boosters for electricity works. See "Official Notices" June 24th.

Johannesburg.—July 29th. Steel work for car-shed buildings, and bridge over railway. See "Official Notices" June 17th.

Lincoln.—July 18th. Traction switchboard for the electricity works, and tramway feeder cables. See "Official Notices" to-day.

London.—July 12th. Three 3-ton electric travelling cranes and two electric locomotives for the wharf of the Greenwich power station of the L.C.C. See "Official Notices" June 17th.

London.—July 12th. The L.C.C. wants tenders for various overhead travelling cranes, and lifting tackle for Greenwich station. See "Official Notices" June 17th.

Manchester.—July 11th. The Paving, Sewering and Highways Committee invites tenders for laying underground telephone pipes (Contract No. 10), with other appurtenant works. Specification, &c., at the City Surveyor's office, Town Hall, Manchester (£2 2s.).

Metropolitan Asylums Board.—July 20th. Tenders for fire alarms at Darenth Asylum, Dartford, and for telephones at the Homerton and Fulham Hospitals. See "Official Notices" to-day.

Mexico.—Tenders are about to be invited for the establishment of a central electric lighting station in the town of Lepic.

Rochdale.—July 18th. Turbo and steam alternators; motor-alternator for electricity works extensions. See "Official Notices" July 1st.

Shanghai.—July 30th. The Municipal Council invites tenders for a 24-mile electric trolley line concession. Particulars from J. Pook & Co., 63, Leadenhall Street, E.C., the London agents of the Council. See "Official Notices" May 13th.

Spain.—July 22nd. The Spanish Post and Telegraph Authorities in Madrid are inviting tenders until the 22nd inst. for the establishment and working of telephone exchanges at Lerida and at El Llano del Beal (Murcia province). Particulars may be obtained from, and tenders are to be sent to, La Direccion Général de Correos y Telegrafos, Calle de Carretas, 10, Madrid.

Stourbridge.—July 8th. Mains (paper), solid system for the U.D.C. See "Official Notices" June 24th.

St. Pancras.—July 19th. Main switchboard at King's Road station. See "Official Notices" June 24th.

Walthamstow.—July 22nd. Cables, troughing, boxes, &c., for two years, for the U.D.C. See "Official Notices" to-day.

Warrington.—July 12th. Steel poles and overhead equipment for light railways, including special swing bridge work over the Ship Canal. See "Official Notices" June 24th.

West Ham.—July 15th. Removal and re-erection of four Babcock boilers. See "Official Notices" to-day.

Whitby.—July 18th. Cables, network and service boxes for the U.D.C. See "Official Notices" July 1st.

Wigan.—July 19th. Booster, switchboard, balancer and cables. See "Official Notices" to-day.

Wimbledon.—July 25th. Refuse destructor extensions for the U.D.C. See "Official Notices" to-day.

CLOSED.

Bristol.—The Bristol Tramway and Carriage Co., Ltd, has placed a contract with the Sunbeam Lamp Co., for the supply of electric lamps for the next 12 months.

Dudley.—The T.C. has accepted the tender of Messrs. Ferranti for a 400-kw. engine and dynamo.

East Ham.—The U.D.C. has accepted the tender, at £679, of Messrs. W. J. Fryer & Co., for the wiring and installation of electric lighting at the technical college.

Exeter.—The City Council on Wednesday accepted the tender of the British Westinghouse Co. for a Belliss engine and electric generator for the electric tramways plant. There were 64 tenders, four of them for turbine engines, but 13 of the firms could not comply with the requirement that the engine should be erected ready for testing in three months, and their offers of delivery ranged from four to seven months.

Finchley.—Messrs. Richard Hornsby & Sons, Ltd., have secured a water-tube boiler contract from the U.D.C. The installation is for the Council's Squire's Lane generating station, to work alongside the existing plant, which is also of the Hornsby "Upright" type.

Halifax.—The tender of the British Insulated and Helsby Cables, Ltd., has been accepted by the Corporation for the supply of certain cables.

Ilford.—The U.D.C. has accepted the following tenders for extension plant:—

Section 1.—British Westinghouse Co., Ltd., 1 000-kw. Westinghouse-Belliss.
Section 2.—Extension to main switchboard, Kelvin & James White, Ltd.
Section 3.—Extension to distributing switchboard, Kelvin & James White, Ltd.
Section 5.—Water purifying plant, Lassen & Hjort.
Section 7.—Feeder pillar, &c., W. T. Henley's Telegraph Works Co., Ltd.

London.—The London County Council received the following tenders for the supply of a 50-kw. generating plant for the Poplar Technical Institute:—

W. Sisson & Co. (accepted)	£475
W. H. Allen, Son & Co.	590
Peter Brotherhood	541
Belliss & Morcom	546

The L.C.C. Fire Brigade Committee recently invited tenders from a number of firms for the wiring and fittings for three stations. The lowest tender—that of Rashleigh, Phipps & Co.—has been accepted in each case, namely, £133 10s. for the Tooley Street station, £121 2s. 6d. for the Bayswater sub-station, and £143 for the Kilburn sub-station.

The undernoted tenders were sent in to the London County Council for the supply and erection of two combined coal and ash conveyors required for use at the Greenwich power station:—

E. Allen & Co.	£4,582
New Conveyor Co. (accepted)	4,763
Babcock & Wilcox	4,970
Blake, Barclay & Co.	6,550
Spencer & Co.	6,881
R. Dempster & Sons	7,270
C. A. Cass	7,393

Salford.—The Tramways Committee has accepted a tender by Messrs. Dick, Kerr & Co., for 10 single-truck double-decked tramcars, with Westinghouse equipment, Brill trucks, steel-tired wheels, and outer deck covers, at £580 per car; also 10 double-truck combination cars with Westinghouse equipment, Brill trucks, and steel-tired wheels, at £697 per car; and two rail-cleaning and watering cars, with Westinghouse equipment, Brill trucks, and steel-tired wheels, at £1,032 10s. each. The Committee recommends the Council to apply for the Board of Trade's sanction to the borrowing of a sum of £16,318 to meet the expense of these cars, and a further sum of £3,530 to provide for the cost of completing the overhead equipment of the tramways in the Whitefield Urban District. A large staff of workmen is engaged on the laying of the Whitefield lines, which will join the Salford tramway system at Unsworth. The completion of the Heaton Park and Radcliffe branches will follow.

Shoreditch.—The B.C. has accepted, for the electric power stations, the following tenders for the supply of coal during the ensuing 12 months:—

Messrs. Gothard & Co., Manners Nuts 12s. 6d. per ton, delivered in barges; ditto. best Welsh smokeless No. 1 Bwllfa, 21s. 4d., delivered in vans.
Messrs. Rickett, Cockerell & Co., Norths Nuts, 20s. 5d., delivered in vans.

Stepney.—The B.C. received the following tenders for wiring and fitting the Whitechapel public baths:—

		£	s
Electric Motor Supply Co., Houndsgate, Nottingham	(accepted)	£237	8
G. Weston & Sons, 153, Fenchurch Street, E.C.		305	0
A. H. Marshall & Co., 270, High Road, Leytonstone		324	0
E. Probert & Co., Walbrook, E.C.		337	11
Donnison, Sillem & Co., 116, Great Portland Street, W.C.		350	0
Jackson Bros., Broadway, Plaistow		359	0
W. J. Fryer & Co., Sloane Square, S.W.		364	0
Eastlakes, Ltd., 1, Carteret Street, Westminster, S.W.		365	10
W. Holmes & Co., 8, Norfolk Terrace, Horsham		372	15
A. Sweet, 100 and 102, Hampstead Road, N.W.		375	0
Smeeton & Page, 63, Queen Victoria Street, E.C.		383	19
E. D. Pearcey, 10, Roscoe Street, Golden Lane, E.C.		386	0
T. Potter & Sons, 44, South Molton Street, Oxford Street, W.		393	0
Willey & Co., Exeter		395	15
Taplin & Mackovski, Ltd., 15, James Street, Haymarket		399	0
J. Richmond & Co., Hatton Garden, W.C.		402	10
F. E. Emerson & Sons, 60, Burdett Road, E.		405	0
Russell & Co., 42, Berwick Street, W.		410	0
Lawrences, Ltd., 6, Spur Street, Leicester Square, W.C.		420	0
Geipel & Lange, 72A, St. Thomas Street, S.E.		428	8
M. Wiedhofft, 42, Upper Street, N.		441	10
Ward Bros., 28A, Basinghall Street		447	3
Glover & Co., 10-12, Garrick Street, W.C.		470	0
C. Ross, Bridge Street, Walsall		475	10
Barlow Bros., 237, Shaftesbury Avenue, W.C.		498	0
J. Defries & Co., 1-6, Gravel Lane, E.C.		520	0
Waring & Withers, 10A, Soho Square, W.		556	16
J. T. Halsey, 24, Great Eastern Road, Stratford, E.		572	18
G. Cohen & Co., 552, Mile End Road, E.		606	7
Electrical Engineering & Maintenance Co., 5, Eastcheap, E.C.		659	0

Stoke-on-Trent.—The T.C. has accepted the tender of the Reason Manufacturing Co., Ltd., for the supply of electric meters, demand indicators, and house service cut-outs.

Warrington.—The Tramways Committee has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for four mechanical stokers at £957; that of Messrs. Bell Bros., for the supply of water softening plant at £450; and that of Mr. J. A. Ewart for the construction of the permanent way of the Stockton Heath tramways at £2,936.

FORTHCOMING EVENT.

Saturday, July 9th.—Junior Institution of Engineers. Visit to Dover.

NOTES.

Third-Rail Fatalities.—A Southport correspondent says that, as a result of the inquiry in Parliament last week, Major Druitt and Mr. Trotter have just paid a visit to Formby and inspected the line and surroundings where the recent accidents occurred, by which one Bootle man lost his life, and another was seriously injured, and also where a soldier was killed on the night of June 25th. In view of the announcement made at the inquest on the last and third victim, the jury decided to make no recommendation to the railway company as to the safeguarding of the line. At the inquest on the Welsh Fusilier, named Robert Collins, aged 21, it was stated that the deceased probably swam the River Alt, as his regimental boots were found on the other side, and his clothing was saturated, thus rendering him extremely susceptible to the electric shock.

One June 30th another fatality occurred at Newcastle-on-Tyne through a lad named Whitehead coming into contact with the third rail while trespassing on the N.E. line. He was discovered lying with his arm on the rail, and artificial respiration failed to revive him. The jury brought in a verdict of "Death while trespassing," adding a rider to the effect that every possible protection against accidents of the kind should be provided. The accident occurred about 10 yards from a crossing. It was admitted in evidence by a companion of the deceased that they climbed the wall in order to cross the line, instead of going home the proper way.

In a House of Commons question on 3rd inst., Mr. Channing asked what orders, if any, had been made by the Board of Trade under Sec. 1, Sub-sec. (f), of the Railways (Electric Power) Act, 1903, for securing the safety of the public; whether such orders included adequate protection from contact with a live rail; whether any of the fatal and other accidents which had occurred from contact with live rails had been found to be due to the neglect of the companies to comply with the terms of orders of the Board, or to neglect of other precautions; and what steps the Board were now taking, or would take, to effectually prevent the recurrence of such accidents. Mr. Gerald Balfour, in reply, said that no orders had yet been made under the Act referred to.

A further question was asked on the general subject, and Mr. Gerald Balfour, in reply, said that when the reports of the inspecting officers had been received the question of precautionary measures would be fully considered.

The St. Louis Electrical Congress.—In our June 24th issue, we gave some particulars of the papers which are to come before several sections of the International Electrical Congress. We have now received the following list of the subjects to come before Sections F. and G.:—

SECTION F.—*Electric Transportation.*—Chairman, Dr. Louis Duncan. Secretary, Mr. A. H. Armstrong.

Ernst Danielson	Theory of Compensated Repulsion Motor.
Philip Dawson	Electrification of British Railways.
Herr F. J. Eichberg	Single-Phase Electric Railways.
Prof. Dr. F. Niethammer	Alternating v. Direct Current Traction.
Prof. Dr. Rasch	The Puffer Machine in Railway Service and its most Suitable Control.
A. H. Armstrong	The Electrification of Steam Lines.
B. J. Arnold	Electric Railways.
Louis Duncan	General Review of Railway Work.
J. B. Entz	The Storage Battery in Electric Railway Service.
C. O. Mailloux	(To be announced later.)
E. H. McHenry	Some Qualifications of Electric Railway Equipment for Trunk Lines.
R. A. Parke	Braking High-Speed Trains.
W. B. Potter	Electric Railways.
F. J. Sprague	The History and Development of the Electric Railway.
L. B. Stillwell	Notes on the Electrical Equipment of the Wilkesbarre and Hazleton Railway Co.
H. G. Stott	Central Station Economics and Operation.
W. J. Wilgus	Equipping the Central Terminal.

SECTION G.—*Electric Communication.*—Chairman, Mr. F. W. Jones. Secretary, Mr. B. Gherardi.

Senor Don Julio Cevera Baviera	Electric Communications in Spain.
Dr. J. A. Fleming, F.R.S.	The Present State of Wireless Telegraphy.
John Hesketh	A New Danger to Lead-Covered Aerial Telephone Cables.
Herr Joseph Hollos	Simultaneous Telegraphy and Telephony.
Saitaro Oi	Telephony and Telegraphy in Japan.
V. Poulsen	System for Producing Continuous Electrical Oscillations.
G. de la Touanne	Questions Connected with Rates and Management in a Telephone Exchange.
J. C. Barclay	Printing Telegraph Systems.
Dr. Albert C. Crehore	Rapid Telegraphy.
Dr. Lee De Forest	Wireless Telegraph Receivers.
Patrick P. Delany	Rapid Telegraphy.
Hammond V. Hayes	Telephony.
Franz J. Dommerque	The Telephone Problem in Large Cities.
Reginald A. Fessenden	Wireless Telegraphy.
J. C. Kelsey	Features of Two-Strand Common Battery Systems.
Kempster B. Miller	Problem. Automatic v. Manual Telephone Exchange.
F. A. Pickernell	Telephony.
Louis M. Potts	Printing Telegraphy.
Col. Samuel Reber	Military Use of the Telephone, Telegraph, and Cable.
Prof. George F. Sever	Electrolysis of Underground Conductors.
L. W. Stanton	Economical Features in Modern Telephone Engineering.
John Stone Stone	The Theory of Wireless Telegraphy.

Up to June 23rd, 1,776 adhesions to the Congress had been received, and over 150 papers promised. 12 of these papers had already been delivered. Arrangements are now being completed for printing papers in advance of the Congress, so that all that are received in sufficient time will be ready for circulation among the Congress members at St. Louis. Efforts are being made to secure as many of the promised papers as possible in advance.

South African Notes (from our Durban correspondent):—

Umtata (Cape Colony).—Plans are being invited by the Umtata Town Council for a combined water and electric lighting scheme.

Pietermaritzburg (Natal).—The Town Council is going to extend the cables in Alexandra and College Roads for the electric lighting of those districts and the Police Barracks and College, at a cost of £1,982.

Greytown (Natal).—At a recent meeting of the Greytown Local Board to deal with the lighting of the town by electricity, Messrs. Collins, Kessler & Co., electrical engineers, of Pietermaritzburg, who at present are running a small plant there, offered the same to the board for £1,000, and £600 to cover the necessary work in connection therewith. A revenue of about £400 per year was estimated.

Ladysmith (Natal).—The financial statement of the electric light department presented at the last T.C. meeting, gives a total expenditure of £15,171, while the receipts amounted to £14,594, the expenditure in excess of receipts being £577.

Johannesburg (Transvaal).—Messrs. Jenkins & Co., of Durban, have just opened a branch of their electrical department in Johannesburg, at the corner of Main and Rissick Streets, having lately secured the contract for the Johannesburg telephone exchange, the plant for which is now on the way out. Messrs. Jenkins & Co. are the agents for the "Ericsson" telephone.

Heilbron (O.R.C.).—The electric lighting concession lately granted to Messrs Harris, Lee & Co., electrical engineers, of Johannesburg, has soon been put into practice for the Heilbron Electric Supply Co. Already 1,500 8-C.P. lamps have been applied for, of which 1,000 are now installed. Applications for power supply to the amount of 20 H.P. have also been received. The erection of the plant is well in hand; a Davey, Paxman loco.-type boiler is in position. The generators are to be Crompton D.C. machines, at 240 volts, with a capacity of 20 KW. each, direct coupled to Peache high speed non-condensing engines. There is a Berryman feed heater and a water-softening plant. A battery of accumulators is also to be installed, having a capacity of 200 ampere-hours, with a hand regulated reversible booster. The switchboard is being supplied by the Electric and Ordnance Accessories Co., Ltd., for whom Messrs. Lee & Co. are agents. Distribution is to be by the two-wire system at 240 volts, the mains being of bare copper carried overhead on steel poles. The meters are to be of the Bastian electrolytic type. The price for current is at a flat rate of 1s. 3d. per unit, with special terms for power consumers.

Another correspondent writes:—

Transvaal.—The annual report of the New Goch Gold Mines, Ltd., states that the generators now supplying current for the lighting of the property are to be discarded, and the lighting done from the new direct-connected set; the rewiring for the new installation is under way.

Cape Town.—The directors of the forthcoming Cape Town Exhibition notify that the Torque Electrical Engineering Co., of Hammersmith (London, Eng.), Cape Town, and Johannesburg, have made arrangements for laying down in a separate building in the Exhibition grounds a complete electric lighting and power plant for the general lighting of the Exhibition, and to meet the requirements of exhibitors. The plant will be 2,000 H.P. of the most recent design and construction, and will demonstrate the most modern applications of electricity to the purposes of lighting, power and heating. Some 1,500 H.P. of the above will be composed of high-speed steam dynamo sets. There will also be employed producer gas in conjunction with high-speed gas engines coupled direct to dynamos, a mode of power production which is coming to the front as being particularly suitable to Colonial service. Polyphase currents, in conjunction with motors, will be available for the use of exhibitors, and will prove a feature of interest to engineers connected with the mining industries. The general lighting of the Exhibition will be carried out by means of some 250 2,000-C.P. arc lamps, the lighting of the exhibitors' stands, and of the advertising signs connected therewith, being carried out by means of incandescent lamps. [Some particulars of the contractors for the installation appeared under "Contracts Closed" last week.]

Glasgow Corporation Telephone Accounts.—A meeting of the Telephone Committee was held on Tuesday afternoon to consider the annual accounts. After considerable discussion—somewhat heated when the Finance Committee was considering them—they were approved. They show the total revenue for the year to be £49,639; working expenditure (including Post Office royalty, £5,007, and terminal fees, £958) amounted to £29,119, leaving a net revenue of £20,519, out of which £16,869 had to be met for interest on loans and sinking fund, leaving a surplus on the year's operations of £3,650. The surplus has been carried forward into the general depreciation fund account, which now stands at £5,743. As regards maintenance, it is stated that the whole plant is being efficiently maintained out of revenue. The capital expenditure for the year amounted to £50,050.

Electrical Exhibition.—The Burton-upon-Trent electricity department is holding an Electrical Exhibition in the Town Hall from July 12th to 16th. Some 26 firms have decided to be represented. The question of motor supply is being specially pushed, and numerous single-phase motors coupled to different machines will be shown in operation. Until a few months ago there was only 60 H.P. on the mains, but this has been increased to 234 H.P., including connections made and applications in hand, and there is another 100 H.P. inquired for; there is undoubtedly a good field for motors.

Chatham Dockyard.—The members of the Dockyard Engine Fitter Apprentices' Association (H.M. Dockyard, Chatham) the other day inspected the large electrical works and car-sheds of the Chatham and District Light Railways Co., at Luton, and also the generating station there. Mr. W. Jensen (the manager) conducted the party through the works.

A Jamaica Disaster.—Central News dispatches from New York report that on Monday a terrible accident occurred in the power house of the electricity works. The accident was due to the flooding of a large pipe conducting water into the works. "There were 60 men working in the pipe at the time, and all were swept into the adjacent river by the terrific inrush of water. No fewer than 34 men were drowned, and 17 others are missing."

Electricity Works Tables.—Addenda.

Bromley (Kent).—Add 1 Economic boiler, 1 Belliss-Parker generating set; total capacity, 1,300 kw.; max. load, 506 kw. Battery max. dis., 760 kw.

Cheltenham and Charlton Kings.—Total capacity, 1,980 kw. Max. load, 1,016 kw. Tudor battery, max. dis. 60 kw. Private lighting, 47,030; public lighting, 387 arc, 20 inc., 3 Nernst; private motors, 6 = 35 h.p.; traction motors, 24 of 35 h.p. = 840 h.p. Total connections = 76,920 8-c.p. Lighting, 6d. to 3½d.; power, 6d. and ½d.; traction, 1·9d. to ·75d. Units sold, 1,469,937. Total costs, 1·46d. per unit.

Cork.—Add 1 Curtis turbine, 1 B.T.H. dynamo. Total capacity 1,850 kw., max. load 906 kw. Total capital, £326,839. Pr. ltg. 34,335; pb. ltg. = 1,700 8-c.p.; pr. 145 = 1,054½ h.p.; tr. 68 = 1,292 h.p.; total conns. = 94,697 8-c.p. Increase 10 per cent. Pb. ltg., arc £15 per ann.; pr. 2d. to 1½d. Units sold 2,490,428. Av. price (ex. tr.) 2·78d. Works and distribution costs 2·26d.; total costs 2·72d.

Exeter.—Supply two-phase, 60 cycles per sec. 6 B. & W. boilers, 4 Belliss-Westinghouse gen. sets, total 1,300 kw. Max. load, 440 kw. Capital outlay, £80,000. Private lighting = 29,040; public lighting = 1,071 8-c.p.; motors, 28 = 60 h.p. Total connections = 31,856 8-c.p. Increase, 16 per cent. Price: private lighting, 5d.; public lighting and power, 2½d. Total units sold, 430,000.

Horsham.—U.D.C. Opened 1902. Eng., J. B. Morgan. 230 and 460 volts d.c. 3 B. & W. boilers, 3 Reavell-G. E. Co. gen. sets, total 280 kw. Max. load 102 kw. E.P.S. battery, max. dis. 125 kw. Callender and J. & P. cables, solid and armd. Private lighting = 4,364; public lighting = 639; motors = 300; total connections = 5,303 8-c.p. Increase 53 per cent. Price: private lighting, 7d. and 3d., or 6d.; public lighting, 4d.; power, 3d. Max. demand and flat rate. Units sold, 69,712. Average price, 5·225d. Works costs, 2·57d.; total costs, 3·76d. per unit.

Newton Abbot.—Max. load 72·5 kw. Battery max. dis. 168 kw. Capital expended, £32,568. Pr. ltg. = 3,544; pb. ltg. 144 Nernst; pr. 8 = 26⅔ h.p.; total conns. = 4,511 8-c.p. Pr. ltg. 7d. and 3d., or 6d.; pr. 4d. and 1½d., or 2½d. Max. demand and flat. Units sold 29,015. Av. price obtd. 4·5d. Works and distribution costs 2 8d.; total costs 3·9d.

St. Helens.—Average price obtained, 1·85d. per unit sold. Works and distribution costs, ·554d. Total costs, ·78d.

Appointments Vacant.—Senior lecturer in electrical engineering for Manchester Municipal School of Technology (£350); headmasters and assistant lecturers are required for several departments at the Belfast Municipal Technical Institute; shift engineer for Manchester (£150); mains assistant (£2 5s.), and linesman for tramways, for West Ham.

Local Authorities and the Supply of Electricity Bill.—An adjourned meeting of the conference of municipal authorities and companies owning electricity undertakings, convened for the purpose of considering proposed amendments of Electric Lighting Acts and Orders, was held on Monday at the St. Pancras Town Hall. The Mayor of St. Pancras (Mr. T. H. W. Idris) presided, and the *Times* records that he reported that Mr. Gerald Balfour had stated that he was not prepared to receive a deputation, but that, as the Supply of Electricity Bill had been referred to a Select Committee, the best course for those interested would be to present their views to the Committee. Mr. Idris further reported that he had that day received a communication from the Hon. T. H. W. Pelham, the assistant secretary of the Board of Trade, who wrote that he was directed by the Board of Trade to state that they proposed to ask the Committee which had been appointed by the House of Lords to consider the Bill, to amend Clause 6, Sub-clause 1, by the addition of a proviso to the effect that the sub-clause should not apply to any provisional order authorising a company to supply electricity (otherwise than in bulk or for power purposes only) so far as the order related to any district in which a provisional order was in force authorising the local authority to supply electricity. The chairman said that he had presented a petition on behalf of the conference against the Bill, submitting that, having regard to the very large expenditure which had been incurred in the establishment of generating stations and to the great inconvenience and additional expense involved by reason of their being subject to injunctions, provision should be made in the Bill whereby they might be empowered to carry on their undertakings in the same manner and with the same exemption in case of actions for nuisance as would have been the case if they had been expressly authorised by Parliament to use the lands in question for working and using generating stations and plant thereon.

The conference confirmed the action of the chairman in presenting the petition on behalf of the conference, and thanked him for his promptness and courage. They also agreed to a proposed amendment of the Bill by the following addition to Clause 1.

4. Where any local authority, company, or person having statutory powers of supplying electricity in any area are, at the date of the passing of this Act, working and using, or have, prior to the passing of this Act, worked and used any generating, transforming, or distributing station upon any lands not specifically authorised by Act of Parliament to be taken or used for that purpose, or have, prior to the passing of this Act, acquired, or contracted to acquire, any such lands for the purpose of erecting thereon any such station, the Board of Trade may, by provisional order, authorise such local authority, company, or person to use or continue to use such lands for working and using thereon a generating, transforming, or distributing station.

It was resolved to approve the action of the Shoreditch Conference in opposing Clause 6. A committee of five, with the Mayor of St. Pancras as chairman, was appointed to watch the Bill through the Committee stage the House of Lords, of and they were empowered to engage counsel and give evidence before the Select Committee.

OUR PERSONAL COLUMN.

[*The Editors invite electrical engineers, whether connected with the power station or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*]

Central Station Engineers.—Last Saturday week the second annual outing of the staff of the Stepney Borough Council Electricity Department took place to Margate. Dinner was served at Munn's Hotel. In the unavoidable absence of Mr. W. C. P. Tapper (the engineer), the chair was taken by Mr. A. J. Somerville. In the afternoon many of the party enjoyed a trip on the electric cars to Broadstairs and Ramsgate, where tea was partaken of.

The York Committee recommends the appointment of Mr. F. E. Wilkinson, of Redhill, Surrey, at present engineer-in-charge of the Reigate Corporation Electricity Works, to the post of engineer-in-charge of the York Electricity Works.

The Derby E.L. Committee has increased the salaries of Mr. W. J. Cox, shift engineer, and of Mr. Lake, shift engineer.

Mr. T. W. Peckham, who for the past three years has been second assistant-engineer at Hastings Corporation Electricity Works, has obtained the post as assistant to Mr. Leonard Andrews, managing director of the Key Engineering Co., Ltd. Mr. Peckham was formerly a pupil of Mr. Andrews, of Hastings.

Mr. J. A. Donachie has been appointed resident engineer at the Scottish House-to-House Electricity Co.'s generating station at Coatbridge.

Electric Tramway Officials.—The Derby Corporation Tramways Committee has appointed Mr. Chas. Beech, of Stockport, as motor instructor and car-shed superintendent, and Mr. Geo. Tuffin as tramways inspector.

Out of 46 applicants Mr. J. Galloway, of Blackburn, has been appointed superintendent of the car depôt by the Tramway Committee of Rochdale T.C. The salary is £150 a year.

General.—Mr. G. Almenrader, who has been with Mr. F. Winter (London agent for Messrs. Dr. Heinr, Traun & Sons), has been appointed assistant manager. Mr. Almenrader has been connected with Mr. Winter's office for the past 18 years.

Mr. F. W. Taylor, the district manager of the National Telephone Co., at Reading, has been promoted to the district managership at Brighton. On Monday, last week, the staff presented him with a silver tea service. Mr. Taylor will be succeeded at Reading by Mr. J. Sinclair Torbas, of Greenock.

Mr. Walter Phillips, late electrical engineer to the Lagos Government, has been appointed consulting electrical engineer to the firm of N. Wadia & Sons, of Bombay; he leaves by the ss. *Victoria* on 15th inst.

NEW COMPANIES REGISTERED.

Hunter Electric Candle Lamp Co., Ltd. (81,387).—This company was registered on June 28th, with a capital of £800 in £1 shares, to acquire certain inventions relating to electric incandescent lamps and fittings, and letters patent and benefit of application relating thereto, to adopt agreements with N. Burt & Co. and C. C. Regnart, and to carry on the business of manufacturers of and dealers in electric candle lamps and fittings, &c. The first subscribers (each with one share) are:—H. D. Blewett, 211-4, Gresham House, Old Broad Street, E.C., insurance broker; H. G. Regnart, Stone Hall, Winchmore Hill, Middlesex, solicitor; H. S. Cooper, 100, Warriner Gardens, Battersea Park, S.W., clerk; C. C. Regnart, Dunkeld, Pinner, electrician C. H. Burt, 195, Wardour Street, W., electrical engineer; W. Last, The Chestnuts, Grove Park, Chiswick, manufacturer; and A. Chalbers, 28, Selwyn Road, Harlesden, N.W., clerk. No initial public issue. The number of directors is not to be less than three nor more than four; the first are C. C. Regnart, C. H. Burt, W. Last and E. Dunand; qualification, £100; remuneration as fixed by the company. Registered office, 17, Newman Street, Oxford Street, W.

Magnetic Separator, Ltd. (81,392).—This company was registered on June 28th, with a capital of £1,250 in 5s. shares, to adopt an agreement with J. T. Dawes, J. M. Moss, W. de Wolf, H. Higginbottom, P. Higson, Margaret Thompson, A. Collier and A. R. Davis, and to carry on the business indicated by the title, and that of ironfounders, electrical and mechanical engineers, manufacturers of scientific, agricultural, industrial and other machinery, tool makers, brass founders, metal workers, boiler makers, millwrights, machinists, iron and steel converters, smiths, woodworkers, metallurgists, &c. The first subscribers are:—J. T. Dawes, The Lilacs, Pentatyn, N. Wales, mechanical engineer, 160 shares; J. Mr. Moss, Llanfairtalhaiarn, N. Wales, secretary, 160 shares; W. de Wolf, Ardmere, Hesketh Park, Southport, merchant, 107 shares; H. Higginbottom, 116, Portland Street, Manchester, merchant, 107 shares; P. Higson, 42, Spring Gardens, Manchester, chartered accountant, 124 shares; Mrs. M. Thompson, Glenville, Stacksteads, 107 shares; and A. R. Davis, 32, Blackfriars Street, Manchester, consulting chemist, 107 shares. No initial public issue. The number of directors is not to be less than three nor more than seven; the first are J. T. Dawes, J. M. Moss, H. Higginbotton, W. de Wolf and A. R. Davis; qualification, £50; remuneration as fixed by the company. Registered office, 57, Tithebarn Street, Liverpool.

Camberley Electric Supply Co., Ltd. (81,400).—This company was registered on June 29th, with a capital of £1,000 in £1 shares. The objects and all other particulars are the same as in the Brentford Electric Supply Co., Ltd. (q.v., p. 67.)

Brentford Electric Supply Co., Ltd. (81,399).—This company was registered on June 29th, with a capital of £1,000 in £1 shares, to carry on the business of electrical and mechanical engineers, contractors, electricians, suppliers of electricity, manufacturers of electrical apparatus, carriers of passengers and goods, owners of railways and tramways, generators, accumulators, transmitters, transformers, users and suppliers of light, heat, sound, and power by electricity, galvanism, magnetism, or otherwise, &c. The first subscribers (each with one share) are:—F. W. Reynolds, Edward Street, Blackfriars Road, S.E., manufacturer; F. E. Savory, Bourne, Farnham, Surrey, director; H. B. Renwick, Burnham, Roehampton, secretary; F. C. McQuown, 194, Regent's Park Road, N.W., electrician; A. S. Cobden, 28, South Villas, Camden Square, N.W., chartered accountant; A. D. Dallas, 53, Egerton Villas, S.W., engineer; and J. J. Lightfoot, 39, Hanover Road, Plumstead, clerk. No initial public issue. The subscribers are to appoint the first directors. Registered office, Moorgate Court, Moorgate Place, E.C.

Hayward's Heath Electric Supply Co., Ltd. (81,403).—This company was registered on June 29th, with a capital of £1,000 in £1 shares, to carry on the business of suppliers of electricity for light, heat, motive power or otherwise, electricians, mechanical engineers, manufacturers of and dealers in apparatus and articles used in connection with the generation, distribution, supply, accumulation and employment of electricity, &c. The first subscribers (each with one share) are:—F. W. Reynolds, Edward Street, Blackfriars, S.E., manufacturer; F. C. McQuown, 194, Regent's Park Road, N.W., electrician; H. B. Renwick, Burnham, Roehampton, S.W., secretary; J. G. Shortis, 4, Bradford Villas, Hindes Road, Harrow; Registrar J. J. Lightfoot, 39, Hanover Road, Plumstead, clerk; J. Hazard, Melrose, Muswell Avenue, Muswell Hill, clerk; and T. F. Bickford, 10, Moorgate Street, E.C., solicitor. No initial public issue. Registered without articles of association. Registered office, Moorgate Court, Moorgate Street, E.C.

Lewis Motor Co., Ltd. (81,425).—This company was registered on June 30th, with a capital of £2,000 in £1 shares, to acquire and become licensors of patents for electric motors, dynamos and other electrical appliances, with a view thereto to adopt an agreement between F. M. Lewis, of the first part, the said F. M. Lewis, B. P. Scattergood, C. H. Johnson, A. R. Chorley, and the Electric Construction Co., Ltd., of the second part, and this company, of the third part, and to carry on the business of manufacturers of electric motors and dynamos and other electrical goods and appliances, electricians, electrical, metallurgical, mechanical, and chemical engineers, suppliers of electricity, contractors for the construction and equipment of tramways and railways with electric or other mechanical power, &c. The first subscribers (each with one share) are:—W. Firth, 8, Alexandra Crescent, Ilkley, solicitor; Mrs. E. M. Scattergood, Moorside, Far Headingley, Leeds; E. Lupton, 27, Whitehall Road, Leeds, cloth manufacturer; F. H. Portway, 1-2, York Place, Leeds, woollen merchant; Dr. A. E. Porter, 41, Park Square, Leeds; H. H. Kitson, St. Ann's Lodge, Burley, Leeds, ironmaster; and R. A. Wilson, Westfield, Armley, Leeds, bank clerk. No initial public issue. The number of directors is not to be less than three nor more than seven; the first are F. M. Lewis, B. P. Scattergood, and A. R. Chorley; remuneration as fixed by the company. Registered office, 4, South Parade, Leeds.

CITY NOTES.

Electric Construction Co.

THE directors' report to be submitted to the meeting to be held on Thursday, July 14th, at Winchester House, at 12.30 p.m., reads:—

The net profit of the year is £14,773 1s. 2d., and adding £4,394 13s. 10d., brought from last year, the amount available for distribution is ..			£19,167 15 0
Your directors recommend that this profit be appropriated as follows:—			
Dividend at the rate of 7 per cent. per annum on the preference shares (to be paid on July 30th next)	£4,394	12 0	
Dividend at the rate of 4 per cent. on the ordinary shares (to be paid on July 30th next)	8,968	0 0	
To general reserve fund (which will then amount to £32,000)	2,000	0 0	
Balance carried forward to next account ..	3,805	3 0	
			£19,167 15 0

The year has been marked by excessive competition among the manufacturers of electrical machinery, and the company's manufacturing profit has inevitably suffered. The competition still continues and the margin of profit at present prices is small. The orders in the books include important contracts with the London County Council and the Great Western Railway Co. Revenue has been charged as formerly with £5,000 for depreciation, also with maintenance and all renewals of plant. The depreciation account now amounts to £53,000. The relations with the employés continue satisfactory, and the usual bonus, but reduced proportionately with the dividend, has been awarded to all who have for twelve months given good and zealous service. The balance-sheet shows an important improvement in the financial position. The company's interest in the Crystal Palace District Electric Supply Co., Ltd., which was taken over from the old corporation, has been sold; and the Madras electric tramways undertaking has been transferred to the Madras Electric Tramways (1904), Ltd., in consideration of £50,000 in cash, and £70,000 in fully-paid shares of that company, which, on the basis of last year's profits should yield a dividend of 5 per cent. The cash thus realised has provided for repayment of the advance from the company's bankers. As the general reserve fund was partly made up of profit on other assets of the old corporation previously realised, that account has been debited with £4,000 to meet the loss in realising these properties. The company's future income will benefit by these realisations.

British Aluminium Co.

MR. H. WOLFENDEN presided at the annual meeting of this company held at Winchester House on Tuesday, in the absence of Mr. J. D. Bonner, who was in attendance at the House of Commons in connection with the company's Loch Leven water-power scheme.

The CHAIRMAN in moving the adoption of the report (ELECTRICAL REVIEW, July 1st), said that it indicated that the company had progressed a long way, during 1903, towards again becoming a dividend-paying concern. He quoted figures to show the great improvement in its financial condition, which resulted from the large net profit which they had made during the year, instead of a loss of £3,392, as in 1902. The position was more satisfactory than the figures might seem to indicate, as the profit would have been considerably larger if the whole of the aluminium they had sold had been produced during the year. As an actual fact they only produced 60 per cent. of that which they sold, the balance being taken from old accumulations of stock which it was desirable to convert into cash even though its realisation did not add to the profits. With a large increase in the production, the profits would be materially enhanced. They were selling all the aluminium they were now producing, and effecting some reduction in stocks in addition. Last year they sold over 30 per cent. more than in 1902, and during the six months of this year ended at June 30th, the sales were greater by 30 per cent. than for the corresponding period of 1903. This extension in sales was of a thoroughly sound character, for it was not due to any great development in any one direction, but was generally spread. It was gratifying that there was no indication of any cessation in the progress. The board had decided to suspend the manufacture of carbide, and apply the whole of the power at Foyers to the production of aluminium. In regard to the development of the Loch Leven water-power scheme, they had come to the conclusion that they ought not longer to delay its development. It involved a large capital outlay, and they had a deep sense of the responsibility they were incurring. The prospect was such that it was important that the increased power should be rendered available for the purposes of the company, and they had accordingly a Bill passing through Parliament which would in due course pass, modifying the powers conferred upon them in 1901. A little later on they would submit for shareholders' approval proposals for providing the necessary capital, although they did not contemplate making any issue until they had before them the results of the current year's trading, which they believed would be highly gratifying. They anticipated that they would be such as would enable the company to recommence the payment of dividends. They were now earning substantial profits, but they must remember that they were at present only at the dawn of their improved circumstances.

Mr. F. ROBINOW seconded the adoption of the report.

Several shareholders asked questions respecting the Loch Leven scheme, and in reply, it was stated that the carbide plant would remain *in situ* until they found it possible to resume its operation after they had ample power for the production of aluminium. The Loch Leven scheme would be much larger than the Foyers undertaking, and the manufacture of aluminium would be principally at Loch Leven. There was not the least necessity for thinking about reconstruction of the company. No additional capital would be raised for the Foyers scheme; it would be exclusively for Loch Leven.

The report was adopted.

The Electric and General Investment Co.

THIS company meeting was held on Wednesday at Winchester House, Old Broad Street, Mr. George Herring presiding.

The CHAIRMAN, in proposing the adoption of the report, said he was sure they were very sorry to submit such a report, considering the prosperous reports they had hitherto presented. Whilst they regretted it for the sake of the shareholders, they were also bound to regret it very much for their own sakes, as they held about one-third of the capital of the company. They had always stated that the prosperity of the company was dependent more or less on the electrical industry, and that industry, for some reason that he could not account for, was, at the present moment, under a cloud. He could not account for it, because the lighting companies were doing very well indeed, and as regarded the traction companies, they were all paying good dividends. Despite all that, the market for industrial electric securities was not good. However, he did not think that, on the whole, they had done very badly, for they had managed to pay a 10 per cent. dividend on the paid-up capital. Although their profit was less than usual, they had made a profit of £15,804, and they had got nearly £8,000 to pay the dividend, including the £1,000 they had already paid. The unfortunate thing was that the dulness of the market in these electric industrial securities had caused the board to consider that it would be imprudent not to add the sum of money —£5,813—that they proposed to add to the contingency fund. He hoped they would agree that the directors were right in so acting, and would believe that it was in the interests of the shareholders as well as of themselves. The sundry creditors appeared in the accounts for £45,730, but, with the exception of a very small amount, the whole of that sum had been paid since the accounts had been issued. The reason they had thought it right to add so much to the contingency fund was because the securities they held did not at the present market value represent the £297,000 at which they stood in the books. With one or two exceptions they were all dividend-paying shares, and he need hardly say that they had no intention of selling any of them at the present depressed prices. He would like to remind the shareholders that since 1891 they had given them back in dividends £3 18s. 1½d. per share on their £1 share, and therefore he thought they ought to submit with a good grace to this reduction in the dividend, and hope that the companies in which they were interested would soon find their shares go back to their normal prices.

Mr. J. B. BRAITHWAITE, jun., seconded the motion, and the report was adopted.

British Electric Traction Co.

THE directors' report to be presented at the meeting to be held at Winchester House on Monday next, July 11th, at 12 o'clock noon, reads as follows:—The profit and loss account for the year ended March 31st, 1904, shows that the total amount for appropriation, including £24,913 brought forward from last year, is £274,730. The premiums, amounting to £30,043, received in respect of debenture stock issued during the year, have not been brought into this

account, but have been carried direct to reserve. The following amounts in respect of interest on debenture stock and dividends on shares, have already been paid or provided for, viz.:—

Interest on 5 per cent. perpetual debenture stock for the year ..		£62,655	12 6
Interest on 4½ per cent. second debenture stock to March 31st, 1904		1,049	0 5
Dividend at the rate of 6 per cent. per annum on the preference shares for the year		92,896	9 6
Interim dividend at the rate of 6 per cent. per annum on the ordinary shares for the half-year ended September 30th, 1903		39,990	6 0
Leaving a balance of £78,138 15s. 9d., which the directors propose should be applied as follows:—			
Dividend at the rate of 6 per cent. per annum on the ordinary shares for the half-year ended March 31st, 1904	£39,990 6 0		
Carried forward to next account	38,148 9 9		
		78,138	15 9
		£274,730	4 2

The sale of the Poole undertaking to the Bournemouth Corporation will be brought into the next year's accounts, although had the price been settled without recourse to arbitration it would have been included in the past year's accounts.

Capital.—During the past year £232,407 5 per cent. perpetual debenture stock has been issued. An issue has also been made of £250,000 4½ per cent. second debenture stock. The subscribed share and debenture capital at March 31st, 1904, was:—

£1,333,010 in ordinary shares of £10 each.
£1,564,370 in 6 per cent. cumulative preference shares of £10 each.
£1,256,225 in 5 per cent. perpetual debenture stock.
£250,000 in 4½ per cent. second debenture stock.

Since the closing of the books, arrangements have been made with a syndicate for the sale of £50,000 5 per cent. perpetual debenture stock, and for an advance to the company of £550,000 by instalments, with a view to the development and completion of undertakings in hand, and an option has been given by the company to the syndicate to call for allotments, at any time before December 31st, 1905, of debenture stocks and shares of the company, the proceeds of any of such allotments to be applied in the first instance to repayment of the above advances, with interest at the rate of 4½ per cent. per annum. The present policy of the directors is to limit as far as possible the further capital commitments of the company.

During the year considerable progress has been made in the development and consolidation of the company's interests in the associated undertakings.

New Lines.—Since the date of the last report, 33·65 route miles of new or reconstructed tramways and light railways have been opened for traffic, by electric traction on the overhead system, namely:—At Airdrie and Coatbridge, 3·4 miles; Auckland, New Zealand, 1·8 miles; Barrow, 3·5 miles; Birmingham District, 7·6 miles; Gateshead, 1·75 miles; Potteries, 1·9 miles; Worcester, 4·9 miles; Yorkshire Woollen District, 8·8 miles.

Total Mileage.—The total mileage of lines in operation by the company and all its associated companies, by electric traction, steam and horses, at December 31st, 1903, was 327·44 as against 288·77 in the previous year; and the mileage of omnibus routes was 68·87 as against 71·62.

Passengers.—The total number of passengers carried on the lines open for traffic in 1903 was 219,714,189, showing an increase of 2·9 per cent. upon the preceding year; and the total traffic receipts amounted to £1,162,605, showing an increase of 2·6 per cent. upon the preceding year.

Electricity Sold.—The total amount received for electricity, sold by the associated electric power and lighting companies in 1903 was £40,345, showing an increase of 5·0 per cent. upon the preceding year.

Birmingham.—The company's investments in the tramway companies in Birmingham and adjacent districts have been merged in the Birmingham and Midland Tramways, Ltd., whose capital has been increased to £1,050,000, and a joint committee of the boards of the following associated companies has been constituted to operate about 95 miles of the companies' tramways and light railways in the district:—

Birmingham and Midland Tramways; City of Birmingham Tramways Co.; Dudley, Stourbridge and District Electric Traction Co.; South Staffordshire Tramways (Lessee) Co.; Wolverhampton District Electric Tramways.

The directors believe that these arrangements will lead to increased economies in working, and enable greater travelling facilities to be afforded. These arrangements should also enable the further capital required by these companies to be raised independently of the B.E.T. Co., and an issue of £200,000 debenture stock has recently been made by the Birmingham and Midland Co. The Corporation of Birmingham having decided to municipalise the tramways within the city, a Bill was promoted in the last session of Parliament by the companies in conjunction with seven local authorities, to authorise (*inter alia*) running powers over the tramways of the Birmingham Corporation after the expiration of the leases in 1906 and 1911, on terms to be agreed, and, failing agreement, on terms to be settled by arbitration. The Bill was strenuously opposed by the Corporation, and the clauses relating to running powers were struck out by Parliament. Temporary agreements have since been made with the Corporation in regard to some of the routes.

Metropolitan Electric Tramways and Power.—Further progress has been made by the Metropolitan Electric Tramways, Ltd., with the important scheme of tramways in North London and light railways in Middlesex and Hertfordshire, and the first section of about 6 miles will, it is expected, be opened for traffic on the overhead system of electric traction in the course of a few weeks. The Metropolitan Electric Tramways Co. has also purchased from the B.E.T. Co. all the shares in the North Metropolitan Electric Power Supply Co., which owns Acts of Parliament giving the right in perpetuity to supply electricity in bulk over an area of about 325 square miles north of London, and an extensive business is in course of being established. A large power house has been erected at Enfield, and another power house at Willesden has been acquired from the Urban District Council, who were advised that it would be more economical to purchase electricity from the Supply Co. in bulk than to generate it themselves for the purpose of retail distribution under their electric lighting order. The undertaking of the B.E.T. Co. to provide capital for the Metropolitan Tramways Co. to the extent of £500,000 has been fully discharged.

Auckland.—The Auckland Electric Tramways Co., in which the company holds ordinary shares of the amount of £287,360, has during the past year opened for traffic all the city lines, and some of the suburban lines. The results of the first year's working are very satisfactory, and indicate that the company possesses a valuable property. The Auckland Co. has, independently of the B.E.T. Co., raised £280,000 by the issue of debenture stock, and has discharged its debt of £150,000 which was guaranteed by the B.E.T. Co.

Poole and District.—The agreement made by the Poole and District Electric Traction Co. with the Bournemouth Corporation for the sale of the undertaking and rights of that company to the Corporation has been confirmed by Act of Parliament, and the sum to be paid by the Corporation is now awaiting the award of the umpire. The company holds about three-fifths of the capital of the Poole company.

Brighton and Worthing.—This company has obtained an Act of Parliament authorising the conversion to electric traction of the Brighton and Shoreham Tramways and the extension of the lines to Worthing. The tenure of the greater part of the lines is for 42 years, with a purchase clause favourable to the company. The Hove and Worthing Electric Tramways, Ltd., has been registered to take over the undertaking. Acts of Parliament have also been obtained authorising the construction of tramways in the neighbourhood of Croydon, and it is proposed to transfer these powers to the County of Surrey Electrical Power Distribution Co., Ltd., whose title it is proposed to alter to the South Metropolitan Electric Tramways and Lighting Co., Ltd. The company's powers for the compulsory purchase of land authorised by the Wellingborough and District Tramroads Act, have been exercised. The Act gives the company a perpetual tenure of the lines which are to be completed by July, 1905. The directors regard these rights as valuable assets and they are included at cost in the balance-sheet.

Pontypridd.—The Pontypridd and Rhondda Valley Tramways are in course of being sold to the local authorities under the compulsory clauses of the Tramways Act, 1870, the efforts of the company to obtain extensions of tenure which would justify converting the lines to electric traction, having failed. The sums to be paid by the local authorities are expected to cover the purchase price paid by the company for the undertaking, but the expenses incurred in the unsuccessful endeavours to obtain extensions of tenure, have been written off as lost.

Yarmouth.—The Yarmouth undertaking is also likely to be purchased by the Corporation under the terms of Sec. 43 of the Tramways Act, 1870, the company having failed to come to an arrangement with the Corporation in regard to extension of tenure and electrical conversion. In this case also the price to be paid by the Corporation is expected to cover the sum paid by the company for the undertaking and the other expenses have been written off.

Swansea.—In February last an important decision was given by Mr. Justice Buckley affecting the tenure of the tramways of the Swansea Improvements and Tramways Co. The Corporation of Swansea made an application to the High Court of Justice for a declaration of their rights of purchase of the tramways, and the decision of the Court entirely confirmed the view of the company that the Corporation's rights of purchase of the different sections of the lines arise at different periods, the first section only being purchaseable in 1906, and that upon any such right of purchase being exercised, the Corporation is bound to grant the company a lease of 21 years of the section purchased, and that, during the continuance of any such lease, the Corporation is unable to purchase any other section.

Motor-Buses.—The directors have given much attention to the question of motor haulage and motor-omnibuses, and have entered upon several experimental enterprises but, so far, without obtaining satisfactory results, and all the expenses incurred have been written off. Experience, however, has been gained in connection with the new industry, which is likely to be of value to the company in future.

The Brush Co.—No return has yet been received upon the ordinary shares held by the company in the Brush Electrical Engineering Co., in which the company is now largely interested, but that company has made satisfactory progress during the past year.

Shanghai.—The company and the Brush Co. jointly obtained a concession for electric tramways at Shanghai, on condition that substantial commencement of the works should be made within one year from April 21st, 1903. In view of the political outlook in the East last year, an application was made for extension of time, which the municipality declined to grant. There was, therefore, no alternative but to accept the suggestion of the municipality and to withdraw from the business, as the directors felt that the expenditure of a large capital on tramways in Shanghai at the present time could not be justified.

Bombay.—The Brush Co. has secured a valuable interest in a concession for electric lighting and tramways in Bombay, and the works for electricity supply are being proceeded with, but the electric tramway enterprise is delayed by various negotiations, and by arbitration proceedings between the Corporation of Bombay and the existing owners of the tramways.

Management.—The board having decided that the extensive business of the company necessitated the appointment of more than one managing director, Mr. Raworth was appointed, in 1901, an additional managing director, with the title of technical director. Mr. Raworth having resigned this position, as from April 1st last, while retaining his seat on the board, Mr. Hilton and Mr. Madgen, members of the board, who have, during the past few years, acted as executive directors, have been appointed managing directors jointly with Mr. Garcke.

The following comparative table of three years' working, which has been supplied to us, will be of interest:—

	1901	1902	1903
Passengers carried	97,671,747	170,940,465	219,714,189
Route mileage	294	360	396
Passengers carried per route-mile ..	332,217	473,168	554,834
Traffic receipts	£563,360	£922,635	£1,162,005
Traffic receipts per route-mile ..	£1,916	£2,563	£2,934
Share capital. Paid up	£2,000,000	£2,758,615	£2,897,366
Debentures issued. Paid up ..	£810,906	£1,059,572	£1,491,178
Total	£2,810,906	£3,818,187	£4,388,544
Total of reserve fund	£459,705	£550,042	£580,085
Gross profit	£203,270	£238,961	£290,123
*General and special expenses ..	£13,412	£13,073	£9,967
Debenture and other interest ..	£34,008	£45,165	£73,820
Preference dividend	£54,847	£74,760	£92,896
Ordinary dividend	£71,511	£105,487	£79,980
Reserve or amounts written off ..	£23,510	£3,052	£20,202
Carry forward	£27,438	£24,912	£98,148

* This item includes administrative and other expenses chargeable after arriving at gross profit.

Thomas Parker, Ltd.

THE annual meeting was held at Wolverhampton on Monday, Mr. C. T. Mander presiding.

The CHAIRMAN, in moving the adoption of the report (which appeared in the columns of the ELECTRICAL REVIEW last week), said, although the company had instituted changes and improvements in the business which had had most beneficial and far-reaching effects, they had, unfortunately, coincided with a period of great depression and competition, so that the profit made was not, in the directors' opinion, sufficient to pay a dividend, and they did not consider it was advisable to draw on the reserve fund. He did not think it would be policy at a public meeting of the company to go into particulars with the shareholders, but the board or staff who were in attendance would be very pleased to meet any shareholders who wished for any further information, and go into full details with them. It was, of course, only technical people and managers of works who could fully understand the problem, but they had various friends with these qualifications amongst the shareholders, and they would no doubt appreciate the work that had been put into the concern, and recognise that they were in good company this year in having to bewail the difficulties of making profits. As he told the shareholders at the last meeting, the types of electrical machinery had entirely changed during recent years, and they were glad to say that their modifications of design had completely met the requirements of the market. They appeared to have been suffering from the same complaint that they saw in nearly all the manufacturing companies which had given the result of their year's working. The general cry was that there did not appear to be sufficient orders to go round and keep people busy. As mentioned in the directors' report, they had considerably increased the amount of work turned out from the shop during the past year, but the value of the orders taken showed a decline in comparison with the year before. This was due to the first six months, but he was glad to say that the orders for the last six months of the year were much more satisfactory and up to the average. This they looked upon as a promise for the future. The economies and modifications in their methods had enabled them to reduce their prices very considerably, and this was probably the reason why the orders in the latter period of the year were more satisfactory, but, of course, the result of this was that more work had to be turned out to get the same value. They had been able to do this, and at the same time reduce the number of their hands, practically dispensing with the night shift, so that they had room in the place to increase their hands once more, and so increase the output when the pressure of orders was sufficient to warrant them doing so. Of course, there was a point at which it did not pay to reduce prices any further, unless they could be justified with further economies. The amount of labour expended on electrical machinery at the present time was reduced to a minimum, and in material they had taken full advantage of the competition in other branches of engineering to get everything at the lowest price consistent with their reputation for first-class work. They were hoping that the continuation of this careful policy would give sufficient work to increase the number of their workpeople again, and so increase the turnover still further during the present year, and as the standing charges were not likely to go up, the full profit on any extra turnover would be entirely to the good. The fact of the matter was that they had been practically creating a new business, and the shareholders must look upon the work of the last year or two, to a certain extent, as the preliminary expense period in a new concern. They had to look back upon eight years in which they had paid dividend amounting to 66 per cent. of the total capital, and they had built up a reserve fund of £17,500, so that although they regretted not being able to maintain this level, they must accept the ordinary fortunes of the manufacturers' business, and take the good years with the bad ones. The board considered that the company was in a first-class position to meet the future, and he did not see why, considering that the board and the staff were at one in their views and that there was no divided interest in the concern whatever, and again considering the small capital, they should not be entering into another period of prosperity. It was something that they had managed to make the great changes and had been able to get about £1,500 to the good, after writing off depreciations to the full extent that they did in previous years. In comparing the profit shown in the present balance-sheet with last year it must be remembered that the last balance-sheet included about £2,000 carried forward from the previous year, whereas the present balance-sheet has only £148, so that the difference in the profits of last year and the year before was not so much as it appeared. Some shareholders last year objected to the board only paying 6 per cent. instead of 10 per cent. as in previous years; the present condition proved that the directors' action was advisable, and the present recommendations were on the same lines—that was, of building a good foundation for the new state of things, which would be strong enough to bear the ordinary fluctuation of trade and business.

Mr. R. ARMSTEAD seconded the resolution, remarking that the company was able to show a little profit, and that they were on the threshold of another period of prosperity. The works, he said, were in such a condition that they were able to cope with any orders that might arise, and they were trying to open up a larger area from which to draw orders.

The report was adopted, several shareholders expressing their dissatisfaction with the state of the business.

Mr. Thomas was re-elected a director of the company, as was also Mr. J. E. Underhill (who filled the vacancy caused by the resignation of Mr. Thomas Parker in February last). Mr. W. A. Nelson was again appointed auditor.

A vote of thanks to the chairman concluded the proceedings.

Electrical Power Storage Co.

THE report of the directors to May 31st, 1904, says that the profit for the year, including the balance of £594 brought forward, is £10,360 10s. 7d. Out of this sum the directors have carried £3,500 to the reserve fund, and £1,000 to the contingent fund. They recommend again the payment of a dividend of 6 per cent. on the ordinary share capital, which will absorb a further £5,389 13s. and leave £470 17s. to be carried forward.

The buildings, plant, tools, &c., have been maintained in thorough repair and condition at a cost of £1,297 16s. 7d., which sum has been provided out of revenue. It affords the directors pleasure to be able to record a successful year in spite of the prevailing dulness of trade and consequent keenness of competition. The company's products continue to give satisfaction to its customers the volume of orders increasing steadily year by year. The retiring director is Sir James Pender, Bart., who offers himself for re-election.

New General Traction Co.

THE eighth annual general meeting of the shareholders of this company was held on Wednesday, at 20, Bishopsgate Street Within, the offices of the company.

The chairman, Baron EMILE B. D'ERLANGER, in moving the adoption of the report and accounts, referred to the fact that there was a loss for the year of £6,659 18s. 10d. After bringing forward from last year the balance of credit of profit and loss, £14,183 3s. 11d, and deducting the amount of loss, £6,659 18s. 10d., there remained a credit balance of £7,523 5s. 1d., and it was recommended by the directors that that should be transferred to a special reserve account. The future of the company depended on the earnings and the dividends paid by the various tramways in which the company was interested. For the present year those receipts were £9,400, against requirements of some £16,000 for fixed charges, interest, &c. Referring to the tramways in Philadelphia, he said that the work over there was resumed during the Spring, and through rail connection had been completed. The board had in fact, just received advices that the cars would be running this week. The receipts from Norwich had improved, showing an increase of £1,250, though there had been some little loss on a matter of paving the streets. No doubt things would be better in the future, but at present there was a very great depression over the Eastern Counties. The receipts from Coventry were about the same; good progress had been made there, and it was expected that the work would be finished before the end of the year. The Douglas season had only just begun.

Mr. WEST seconded the motion.

A SHAREHOLDER pointed out that no dividends had been paid for three years, and it was not encouraging.

Mr. GUSTAF SCHACK-SOMMER advised the appointment of a committee of shareholders to look into the affairs of the company. He thought it would be more satisfactory to the directors and the shareholders.

Another shareholder, Mr. KITCHEN, deprecated the idea of appointing such a committee. It would not be likely to create a good effect outside. Whenever a shareholder wished to know anything, he was at once put in possession of every particle of information he could have by the chairman and the other directors or the secretary.

The CHAIRMAN, in reply, said that he had never held out hopes or sanguine prospects, but he believed that there were possibilities in the future, though they would be deferred. He himself had had to suffer very considerably, not only as a preference shareholder, but as a holder of ordinary shares, of which he bought some 4,000 to 6,000 at £4 a-piece. He was perfectly willing to have a committee of inquiry.

The report and accounts were adopted. The motion for the transference of the credit balance was then carried, and the

chairman was re-elected on the board. The auditors, Messrs. Deloitte, Dever, Griffiths & Co. having been appointed, the proceedings terminated.

Prospectuses.—In our advertisement pages to-day will be found the prospectus of the ELECTRIC SUPPLY CORPORATION, which is to carry out provisional orders for electricity supply in 18 towns in England and Scotland. The nominal capital is £250,000, and 46,600 shares of £5 each are now offered at par. The orders have been obtained by Messrs. Crompton & Co., Ltd., who take no promotion money beyond bare expenses, but they are under agreement to carry out all of the installations at a profit of 15 per cent. upon prime cost. The list of applications opens on Tuesday, and closes on Friday next.

We understand that the BLACKHEATH AND GREENWICH ELECTRIC SUPPLY Co. is changing its name to the South Metropolitan Electric Light and Power Co., and that it has just issued a prospectus among the shareholders offering 30,000 7 per cent. £1 preference shares for subscription at 23s., also £30,000 4½ per cent. debenture stock at par.

HYATT'S, LTD., has been before the public this week with an issue of 55,000 £1 shares. The total nominal capital is £80,000. The company is to carry on business as manufacturers of Hyatt belt for driving machinery. Mr. Frank Rowley, late of F. Reddaway & Co., Ltd., is managing director of the new business.

A prospectus of T. H. P. DENNIS & SON, LTD, electrical engineers, general ironmongers and contractors, of Chelmsford, has been published locally. The business was established over a century ago. The capital is £30,000, in 10,000 preference and 20,000 ordinary shares.

We understand that a prospectus is being circulated of L'ENERGIE ELECTRO-MECANIQUE SOCIETE ANONYME FRANCAISE (en Formation). The nominal capital is 1,250,000 francs, and some 7,700 shares of 100 francs each are being offered. One of the chief objects of the company is to manufacture in France under the Berry transformer patents which have operated so successfully in England, and naturally much is made in the prospectus of the success of the British Co. The company will also work the patents of A. Lavo for dynames and electro-mechanical appliances. M. Lavo has been offering shares to the shareholders of the British Electric Transformer Co., Ltd., in this country, and the latter company will be represented on the board of the French Co.

Davy Brothers, Sheffield.—The report for the year ended April 30th last, states that the gross profit for the year amounted to £10,213. From this has to be deducted interest and depreciation, leaving a net profit for the year of £6,379. The directors recommend a dividend of 4 per cent. on the ordinary shares, transferring to reserve £3,000. During the past year the general depression in the steel trade has reduced prices very materially, besides making orders very difficult to obtain. The new installations of the Ellis and Eaves' system of heated induced draught, which have been put into use during the past year, are giving extremely good results. A considerable increase in this business is anticipated. The company has a fair amount of work at present on hand.

Greenwood & Batley, Ltd.—The report for the 12 months ended March 31st, states that after providing for interest on the debentures and expenses of management, and making due provision for doubtful accounts, the accounts show a profit of £25,978, making, with the amount brought forward, £29,284. The directors have written off £5,000 for depreciation of plant, and have appropriated £5,000 to writing down book value of investments, and they recommend that dividends for the year ended March 31st last be declared at the rates of 7 per cent. per annum on preference share capital and of 5 per cent. per annum on the ordinary share capital, leaving £3,668 to be carried forward.

Metropolitan Electric Supply Co.—The board recommends the payment of a bonus of £6 per share, payable on the 19th inst., to holders of ordinary shares, out of the profits on capital account made by the sale of the Marylebone undertaking; and at the extraordinary general meeting on that date the chairman will explain the views of the board as to dealing with the balance of the purchase money. The price of the shares yesterday rose from 21 to 22 on the strength of this announcement.

Stock Exchange Notices.—The Committee has appointed Wednesday, July 20th, as a special settling day in Rhodes Electrical Manufacturing Co., Ltd., 6,135 ordinary shares of £1 each, fully paid, Nos. 35,001 to 41,000 and 43,101 to 43,235; and 33,000 vendors' ordinary shares of £1 each, fully paid, Nos. 5,001 to 35,000, 41,001 to 43,100 and 43,236 to 44,135.

City of Buenos Ayres Tramways Co.—An extraordinary general meeting of this company will be held at Winchester House on July 18th for the purpose of considering resolutions providing for the transfer of the company's undertaking to the Anglo-Argentine Tramways Co., Ltd., upon terms provisionally agreed to.

St. James's and Pall Mall Electric Light Co.—The directors have this week declared an interim dividend on the preference shares at the rate of 7 per cent. per annum, and on the ordinary shares at the rate of 10 per cent. per annum for the half-year ending June 30th. The share transfer books will be closed from July 16th to July 30th inclusive.

STOCKS AND SHARES.

Wednesday Evening.

OUTSIDE attractions at Henley and at Lord's have combined with lack of business to make the Stock Exchange a most uninteresting place this week. It is far more trying to stand about the markets all day doing nothing than it is to be overdriven with work, and many members are putting in intermittent appearances only. Money, as was expected, shows signs of becoming decidedly cheaper, but the benefits that were to accrue from the turning of the half-year are still insufficient to stimulate fresh business in the Stock Exchange. Several new companies, however, are braving the placid calm of the financial sea, and there are not a few items afoot of considerable interest with regard to electrical undertakings.

After their recent dulness, Edmundson's are again creeping to the front, and the Ordinary are ⅛ better at 6 middle. The Debenture stock has also hardened a point to 108½, and we understand that nearly all the recent issue of Urban Debentures is now placed in the hands of permanent investors. The price has risen to ½ premium. Electric Construction Ordinary at 1⅜ have shed 2s. 6d. upon the publication of a report which only the hardiest optimist could describe as good. The Preference shares and Debenture stock remain at 2½ and 98½ respectively.

Substantial rises have been secured by Anglo-Argentine Tramways and City of Buenos Ayres Tramways 6 per cent. Debenture stocks, the former being quoted 137½, and the latter 142½, both *ex* the 3 per cent. interest deducted last week. The improvement is more nominal than real, so far as dealing in the stocks is concerned, because it has been a matter of great difficulty for some time past to get the offer of either security. The scheme for the amalgamation—that is what the arrangement amounts to—is regarded with favour by the market. If one company scores more than the other, it is thought that the City of Buenos Ayres has perhaps done rather the better of the two, and the shares are a good market at 9⅞. Anglo-Argentine 5 per cent. Preference, which will be 5½ per cent. Preference if the scheme is sanctioned, are firmer at 5⅛ bid, and the Ordinary keep about 6, which is 10s. above the issue-price of £5 10s. We may perhaps be forgiven a hope that followers of this column took the hint to buy the two Debenture stocks just mentioned when the attractions of those investments were being regularly urged.

Falls of 5s. have taken British Electric Traction Ordinary to 9½, and the Preference to 10⅜. An exhaustive summary of the company's interests appears in an evening contemporary, and is not calculated to encourage high hopes of bountiful dividends for some time to come. London United Tramways Preference at 11 *ex* their 5s. dividend are really unaltered, and the Debenture stock at 103 is also *ex* the interest. Metropolitan Electric Trams Deferred were sold last Tuesday at 2s. 6d., and the Preference at 17s. 6d. Potteries Preference have been done at 9½. North Metropolitan shares are 2½, a shade firmer on the week. Dublins at 13 are unaffected by the 6 per cent. dividend, and Bath Electric Preferred have slipped back $\frac{1}{16}$ to 15s.

Home railway stocks continue to be erratic, but the tendency is to put prices better on balance. Districts are a trifle up at 38⅜, while Metropolitans at 96½ have fallen ¼. Central London Preferred at 103½ has added a point, the other issues not changing. City and South London at 48 remains dullish. Great Northern and City Preferred "A" shares eased off to 5, which is just half their par value.

Beyond the differences produced by marking certain stocks *ex* dividend, the telegraph section has not much change to display. West India and Panama first Preference have moved up ¼ to 6½, and Western Telegraph shares are a like fraction lower at 12⅜. In several instances among the Debenture stocks, the amount of the interest has been either partially or fully recovered in the prices. Cuba Submarine shares are 10s. lower at 7. Two or three Telephone issues have advanced, National Deferred at 88½, being 3 points to the good, and the 4 per cent. Debenture at 104, also a brace of points up. The new National Debenture stands at 66, as there is now only 35 per cent. to be paid. United River Plate Ordinary, at 6, have regained their last week's drop of ¼, and the 5 per cent. Debentures are 1 per cent. firmer, at 104½.

Investment purchases of British Insulated and Helsby Cables shares have lifted the prices to 6 for Ordinary and Preference, while Edison & Swan Second Debenture is 2 up, at 76½. Westinghouse Preference are at 3½, and the Debenture stock, 85½ *ex* dividend.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1901.	1902.	1903.	Closing Quotations June 29th.	Closing Quotations July 6th.	Business done week ended July 6th, 1904. Highest	Lowest
67,100	African Direct Telegraph, 4 % Debs.	100	..	..	..	99 —103	97 —101 xd	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	..	..	..	2½ — 3½	2½ — 3½	..	..
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,950 Red.	100	..	..	..	.. — ..	70 — 80	..	..
788,840	Anglo-American Telegraph	Stock	61s.	60/6	61s.	46 — 49	46 — 49	..	..
3,105,680	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	91 — 93	91 — 93	92⅜	91½
3,105,680	Do. do. do. Deferred	Stock	2s.	1/-	2s.	6¾ — 7	6¾ — 7	6⅞	6⅝
44,000	Chili Telephone, Nos. 1 to 44,000	5	5 %	6 %	..	4⅞ — 5⅛	4⅞ — 5⅛	..	..
18,333,300$	Commercial Cable	$100	8 %	8 %	..	170 —190 xd	170 —190 xd	..	..
1,841,209	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	..	..	..	93 — 95 xd	93 — 95 xd	..	..
16,000	Cuba Telegraph	10	4 %	6¾%	5 %	7 — 8	6½ — 7⅛	..	..
6,000	Do. 10 % Pref.	10	..	..	..	15 — 16	15 — 16	..	..
12,981	Direct Spanish Telegraph	..	..	..	..	.. — ..	.. — ..	..	..
6,000	Do. do. 10 % Cum. Pref.	5	..	..	..	7 — 8	7 — 8	..	..
80,000	Do. do. 4½ % Debs.	50	..	..	..	100 —103⅝	98 —101⅝xd	..	..
60,710£	Direct United States Cable	20	8½%	8½%	..	10 — 10½	10 — 10½	..	..
81,800	Direct West India Cable, 4½% Reg. Deb., within Nos. 1 to 1,900, Red.	100	..	..	..	100 —103	99 —101 xd	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	..	126 —131	126 —131	130	128½
1,955,565	Do. 8½ % Pref. Stock	100	..	..	..	97 — 90	87 — 90	89½	87½
1,584,645	Do. 4 % Mort. Deb. Stock Red.	Stock	..	..	..	105 —109	105 —108	106½	105
800,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	7 %	11¾ — 12¼	11¾ — 12¼	12⅛	12⅛
850,000£	Do. 4 % Deb. Stock	Stock	..	..	..	105 —108	105 —108	..	..
800,000	Eastern & South African Tele., 4% Mt. Db., Nos. 1 to 8,000, red. 1909	100	..	..	..	99 —102	99 —102	..	..
200,000£	Do. do. 4 % Reg. Mort. Debs. (Mauritius Sub.) 1 to 8,000	25	..	..	..	99 —102	99 —102	100	..
180,297	Globe Telegraph and Trust	10	5½%	£3 16 7*	5½%	8¾ — 9¼	8¾ — 9¼	9	8⅝
180,042	Do. do. 6 % Pref.	10	..	..	..	13 — 13½	13 — 13½	13⅜	13⅛
150,000	Great Northern Telegraph, of Copenhagen	10	15 %	12½%	15 %	25½ — 26½	25½ — 26½	..	..
54,700	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	..	..	..	100 —103	99 —101	..	..
17,000	Indo-European Telegraph	25	10 %	10%	10 %	42 — 45	42 — 45	..	..
1,988,888	National Telephone, Pref. Stock	100	5 %	6 %	6 %	104 —106	104 —106	105½	103
1,966,667	Do. do. Def. Stock	100	..	4½%	5 %	84 — 87	87 — 90	88½	84
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	11 — 13	11 — 13	12⅜	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	11 — 13	11 — 13	..	..
2,250,000	Do. do. 5 % Non-cum. 3rd. Pref., 1 to 250,000	5	5 %	5 %	5 %	5 — 5½	5 — 5½	5 1/16	..
000,000£	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	97 — 99 xd	97 — 99 xd	99	98⅛
689,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	101 —103 xd	103 —105 xd	102⅝	..
1,000,000	Do. do. Prov. Certs., 70 % to be paid	..	..	..	..	29 — 31	29 — 31	..	..
179,313	Oriental Telephone and Elec. Nos. 1 to 171,604, fully paid	1	6 %	6 %	6½%	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..
50,000	Do. do. do. 6 % Cum. Pref.	1	..	..	..	1 — 1⅛	1 — 1⅛	1 1/16	..
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	..	..	..	97 —100	97 —100 xd	..	..
11,889	Reuter's	8	5 %	..	..	6¾ — 7⅛	6¾ — 7⅛	..	..
3,308	Submarine Cables Trust	Cert.	..	..	..	118 —123	118 —123	120	..
58,000	United River Plate Telephone	5	7 %	7 %	..	5⅜ — 6¼	6 — 6¼	6 1/16	6⅛
40,000	Do. do. 5 % Cum. Pref., Nos. 1 to 40,000	5	..	..	..	4¾ — 5¼ xd	4¾ — 5¼xd	..	..
179,947£	Do. do. 5 % Debs.	Stock	..	..	..	102 —105 xd	103 —106	..	..
15,609	West African Telegraph, Shares	10	..	2 %	4 %	6 — 7 xd	6 — 7	..	..
150,000£	West Coast of America, 4% Debs., 1 to 1,500 guar. by Brzs. Sub. Tel.	100	..	..	..	97 —100	95 — 98 xd	..	..
267,980	Western Telegraph, Ltd., Nos. 1 to 207,980	10	7 %	7 %	7 %	12¾ — 13¼ xd	12½ — 13 xd	12⅝	12⅝
75,000£	Do. do. 5 % Debs. 2nd series, 1906	100	..	..	..	102 —105	101 —104 xd	..	..
400,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	100 —103	99 —102 xd	..	..
88,321	West India and Panama Telegraph	10	..	..	..	⅜ — ½	⅜ — ½	..	..
84,568	Do. do. do. 6 % Cum. 1st Pref.	10	..	..	..	6 — 6¼	6¼ — 6⅜	6⅜	6¼
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	..	..	..	5 — 6	5 — 6	..	..
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	..	..	..	100 —103	99 —102 xd	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

30,000	British Aluminium 7 % Cum. Pref.	10	..	..	..	5 — 6	5 — 6	..	..
300,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	..	..	..	90 — 95	92 — 97	..	..
100,000	British Electric Traction	10	9 %	8 %	..	9¼ — 10	9¼ — 9¾	9⅜	9¼
100,000	Do. do. 6 % Cum. Pref.	10	..	..	..	10¾ — 11¼	10¼ — 11	10 1/16	10⅛
600,000£	Do. do. 5 % Perpetual Debenture Stock	Stock	..	..	..	115 —118	115 —118	117½	116½
100,000	British Insulated and Helsby Cables	5	10 %	10 %	8 %	5⅜ — 6	5⅜ — 6⅛	5 7/16	..
100,000	Do. do. 6 % Cum. Pref.	5	..	..	..	5¾ — 6	5⅞ — 6¼	6	..
50,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	..	..	..	101 —104 xd	101 —104 xd	102¼	..
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	..	..	⅞ — 1 1/16	⅞ — 1 1/16	..	..
40,000	¶ Do. do. 6 % Cum. Pref.	£1	6 %	..	..	14/6 to 15/6	14/6 to 15/6	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	9	Nil	Nil	Nil	½ — 1	½ — 1	..	..
150,000	Do. do. Non-cum. 6 % Pref.	9	3 %	6 %	6 %	¾ — 1¼	¾ — 1¼	1	..
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	..	..	..	96 — 99	96 — 99	..	..
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	..	..	..	71 — 76 xd	71 — 76 xd	..	..
85,000	Callender's Cable Construction shares	5	20 %	15 %	12½%	9½ — 10¼	9½ — 10¼	10	..
40,000	Do. do. do. 5 % Cum. Pref.	5	..	..	..	5¾ — 5⅞ xd	5¾ — 5⅞ xd	..	..
90,000£	Do. do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	..	..	..	101 —105 xd	102 —106 xd	105	..
1,860,014	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	90 — 93	90 — 93	92½	92
494,998	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	101 —104	102 —105	104	..
494,998	Do. do. Def. do.	Stock	4 %	4 %	4 %	79 — 82	79 — 82	..	..
1,330,000	City and South London Railway	Stock	2 %	2½%	2⅝%	47 — 49	47 — 49	48⅜	47⅛
85,000	Crompton & Co., Nos. 1 to 85,000	5	7½%	6 %	..	1¾ — 2¼	1¾ — 2¼	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., to 900 of £100, and 901 to 11,000 of £50 red.	..	..	..	..	95 — 98	93 — 96 xd	..	..
99,261	Edison & Swan United Elec. Light, "A" shares, £3 paid, 1 to 99,261	5	Nil	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..
17,139	Do. do. "A" shares, 01—017,139	5	Nil	Nil	..	1 — 2	1 — 2	..	..
44,028£	Do. do. 4 % Deb. Stock Red.	100	..	..	..	72 — 77 xd	74 — 79 xd	77½	..
100,000£	Do. do. 5 % In Deb. Stock Prov. Certs. all pd.	100	..	..	..	75 — 79	75 — 79	..	..
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	4 %	1⅜ — 1⅝	1⅜ — 1⅝	1⅜	1¼
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	..	..	..	2¼ — 2⅜	2¼ — 2⅜	..	..
82,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock	Stock	..	..	..	97 —100	97 —100	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	..	9 — 9¼ xd	9 — 9¼ xd	..	..
900,000	Do. do. 4 % Mort. Deb.	Stock	..	..	..	93 — 98	93 — 98	..	..
200,000	Henley's (W. T.) Telegraph Works, Ord.	5	20 %	20 %	15 %	11¼ — 12¼	11¼ — 12¼	..	..
200,000	Do. do. 4½ % Pref.	5	..	..	..	5 — 5⅛	5 — 5⅛	..	..
45,900	Do. do. 4½ Mort. Deb. Stock	Stock	..	..	..	107 —111	107 —111	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works	10	10 %	10 %	..	18¼ — 19¼	18¼ — 19¼ xd	18⅞	18⅝
800,000£	Do. do. 4 % 1st Mort. Deb.	100	..	..	..	100 —103	100 —103	100½	..
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	1½%	..	3¾ — 4	3¾ — 4	..	..
10,000	† Do. do. Pref. £10 paid	10	..	..	..	10 — 10½	10 — 10½	..	..
37,350	Telegraph Construction and Maintenance	12	20 %	20 %	20 %	36 — 39	36 — 39	39½	36½
150,000£	Do. do. 4 % Deb. Bds., Nos. 1 to 1,500 Red. 1909	100	..	..	..	101 —104	99 —102 xd	..	..
540,000£	Waterloo & City Railway, Ord. Stock	100	8 %	8½%	8½%	89 — 92	89 — 92	..	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ From Manchester Share List.

Bank rate of discount 3 per cent. (April 21st 1904).

SHARE LIST OF ELECTRICAL COMPANIES (*continued*).—ELECTRICITY SUPPLY COMPANIES.

Present issue.	NAME.	Stock or Share.	Dividends for the last three years 1901.	1902.	1903.	Closing Quotations June 29th.	Closing Quotations July 6th.	Business done week ended July 6th, 1904. Highest.	Lowest
100,000	Blackheath and Greenwich Dist. Electric Light, Ord...	‡	..	..	..	⅜ — ½	⅜ — ½	..	..
50,000	Do. 7 % Pref.	1	..	..	..	1⅛ — 1¼	1⅛ — 1¼	..	..
100,000	Do. 4½% 1st Deb. Stock, Prov. Certs. ..	100	..	..	..	120 —125	122 —127	123	..
20,000	Brompton & Kensington Electric Light Sup., Ord., 1 to 20,000 ..	5	8 %	8 %	10 %	10½— 11½	10½— 11½	..	..
20,000	Do. do. 7 % Cum. Pref. ..	5	..	..	..	10¼— 10½	10¼— 10½	..	..
250,000	Central Electric Supply 4 % Guar. Deb. Stock	100	..	..	..	105 —108	105 —108	..	..
50,000	Charing Cross and Strand Electricity Supply	5	10 %	10 %	8 %	7⅞— 8	7⅞— 8	7⅞	7 1/16
70,000	Do. do. do. 4½% Cum. Pref. ..	5	..	..	..	5⅛— 5⅜	5⅛— 5⅜	5 5/16	..
40,000	Do. do. "City Undertaking" 4½% Cum. Pref. ..	5	..	..	..	4⅜— 5 xd	4⅜— 5 xd	4 13/16	..
40,000	Do. do. 1903	5	..	..	..	4⅜— 5 xd	4⅜— 5 xd	4⅜	..
250,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	102 —104	102 —104	103½	102
44,436	*Chelsea Electricity Supply, Ord.	5	4 %	4½%	5¼%	6½— 6⅝	6½— 6⅝	..	..
150,000	Do. do. % Deb. Stock Red.	Stock	..	..	..	106 —109 xd	106 —109 xd	..	..
70,595	City of London Electric Lighting, Ord. 40,001—110,595 ..	10	5 %	5 %	5 %	11— 11½	11— 11½	11½	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	..	..	..	13 — 14	13 — 14	..	..
400,000‡	Do. 5 % Deb. Stock, Scrip. (iss. at 115) all paid	..	..	..	..	120 —125 xd	103 —105 xd	..	..
800,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	..	..	..	101 —104 xd	101 —104 xd	102⅝	103
40,000	County of London & Brush Prov. Electric Lighting, Ord. 1—40,000..	10	4 %	4 %	4 %	7½— 8½	7½— 8½	..	..
20,000	Do. do. do. 6 % Pref., 40,001—60,000..	10	..	..	..	11 — 12	11 — 12	..	..
400,000‡	Do. do. 4½% Deb. Stock	..	..	..	..	104 —107 xd	104 —107 xd	..	..
250,000	Do. do. 4½% 2nd Deb. Stock	Stock	..	..	..	100 —103	100 —103	..	..
50,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	..	5⅞— 6	5⅞— 6⅛	6	5 1/16
30,000	Do. do. 6 % Cum. Pref.	..	..	..	..	5⅞— 5⅞	5⅞— 5⅞	..	..
140,000	Do. do. 4½% 1st Mort. Deb. Stock ..	100	..	..	..	106 —109	107 —109	109	109
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	12%	12 — 13	12 — 13	..	..
90,000	Do. do. do. 4 % Debenture Stock ..	Stock	..	..	..	103 —105	102 —105	..	..
110,000	London Electric Supply Corporation, Limited, Ord.	8	..	..	..	1½— 1⅝	1½— 1⅝	..	..
49,840	Do. do. do. 6 % Pref.	5	..	..	..	4¼— 5⅛	4¼— 5⅛	..	..
250,000‡	Do. do. do. 4 % 1st Mort. Deb. Stock Red	Stock	..	..	..	93 — 96	94 — 96	..	..
100,000	Metropolitan Electric Supply, 1 to 100,000	10	6¼%	7½%	8⅓%	19½— 20⅜	20½— 21½	21½	20⅞
71,106	Do. do. 4½% Cum. Pref. 1—71,106, £3 paid ..	5	..	..	..	5¼— 5⅜xd	5¼— 5⅜ xd	5⅜	..
220,000‡	Do. do. 4½% 1st Mort. Deb. Stock	..	..	..	..	108 —112 xd	108 —112 xd	110½	..
250,000‡	Do. do. 3½% Mort. Deb. Stock Red	Stock	..	..	..	96 — 99 xd	96 — 99 xd	..	..
10,852	Notting Hill Electric Lighting	10	6 %	6 %	6 %	13 — 14 xd	13 — 14 xd	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	14½— 15⅝	14½— 15⅝	..	..
20,000	Do. do. do. 7 % Pref. 20,081 to 40,080	5	..	..	..	8 — 9	8 — 9	..	..
150,000‡	Do. do. do. 3½% Deb. Stock Red ..	100	..	..	..	96 — 99 xd	96 — 99 xd	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	..	2½%	4 %	2⅜— 2½	2⅜— 2½	..	..
50,000	Do. do. do. 4 % Deb. Stock	Stock	..	..	..	85 — 90	85 — 90	..	..
65,000	South London Electricity Supply, Ord.	5	..	1½%	3 %	3⅞— 4⅛	3⅞— 4⅛	4 3/32	4
30,000	Urban Electric Supply, Ord.	5	..	..	..	4⅛— 5	4⅛— 5	..	..
30,000	Do. do. 5 % Cum. Pref.	5	..	..	..	4⅛— 5	4⅛— 5	..	..
110,000	Westminster Electric Supply, Ord.	5	10½%	12 %	13½%	12⅜— 13⅛	12⅜— 13⅛	12 15/16	..
28,141	Do. do. 5 % Cum. Pref.	5	..	..	..	6¼— 6⅜	6¼— 6⅜	6⅜	6 5/8

* Subject to Founders Shares. ‡ Unless otherwise stated all shares are fully paid.

MARKET QUOTATIONS. Wednesday, July 6th.

CHEMICALS, &c.

		Latest Price.	Week's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	33/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	..
a ,, ,, ...	per ton	£30	..
a Bleaching powder	per ton	£4 10	..
a Bisulphide of Carbon	per ton	£15	..
a Borax	per ton	£13	..
a Benzole (90 %)	per gal.	7/-	..
a ,, (50/90 %)	per gal.	5/6	..
a Copper Sulphate	per ton	£21 10	..
a Lead, Nitrate	per ton	£24	..
a ,, White Sugar	per ton	£31	..
a ,, Peroxide	per ton	£27 10	..
a Methylated Spirit	per gal.	2/6	..
a Naphtha, Solvent (90% a 160° C).	per gal.	5/6	..
a Potash, Bichromate, in casks ..	per lb.	3d.	..
a ,, Caustic (75/80%).. ..	per ton	£24	..
a ,, Bisulphate	per ton	£35	..
a Shellac	per cwt.	220/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a ,, Crystals	per ton	£3	..
a ,, Bichromate, casks.. ..	per lb.	2½d.	..

METALS, &c.

b Aluminium Ingots, in ton lots ..	per ton	£130	..
b ,, Wire, in ton lots ..	per ton	£168	..
b ,, Sheet, in ton lots ..	per ton	£166	..
p Babbitt's metal ingots	per ton	£48 to £130	..
c Brass (rolled metal 2' to 12') basis	per lb.	6¾d.	..
c ,, Tube (brazed)	per lb.	8¼d.	..
c ,, ,, (solid drawn).. ..	per lb.	7¼d.	..
c ,, Wire, basis..	per lb.	6¾d.	..
c Copper Tubes (brazed)	per lb.	9¼d.	..
c ,, ,, (solid drawn) ..	per lb.	9¼d.	..
a Copper Bars (best selected ..	per ton	£69	..

METALS, &c. (*continued*).

		Latest Price.	Week's Dec. or Inc.
g Copper Sheet	per ton	£69	..
g ,, Rod	per ton	£69	..
c ,, (Electrolytic) Bars ..	per ton	£62	..
c ,, ,, Sheets ..	per ton	£78	..
c ,, ,, Rod	per ton	£72	..
c ,, ,, H.C. Wire	per lb.	7¾d.	..
f Ebonite Rod	per lb.	8/8	..
f ,, Sheet	per lb.	8/-	..
n German Silver Wire	per lb.	1/6	..
h Gutta-percha fine	per lb.	8/-	..
h India-rubber, Para fine	per lb.	4/8 to 4/9½	..
i Iron, Charcoal Sheets	per ton	£18	..
i ,, Pig (Cleveland warrants)	per ton	42/6	..
i ,, Forgings, according to size	per ton	From £11	..
i ,, Scrap, heavy	per ton	47/6 to 50/-	..
i ,, Wire, galvanised No. 8 ..	per ton	£9 15	..
g Lead, English Ingot	per ton	£12	inc.
g ,, ,, Sheet	per ton	£11 17s. 6d.	..
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8	..
d Mica (in original cases) small ..	per lb.	6d. to 1/	..
d ,, ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, ,, large ..	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/- to 1/2½	..
p ,, rolled bars & rods	per lb.	1/- to 1/8	..
p ,, ,, strip & sheet	per lb.	From 1/1	..
o Platinum	per oz.	£4	..
c Silicium Bronze Wire	per lb.	9d. to 11d.	..
i Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
i ,, ,, in bars		£15 to £40	..
g Tin, Block	per ton	£119 to £120	..
g ,, Foil	per lb.	1/6	..
n ,, Wire, Nos. 1 to 16	per lb.	1/6½	..
p White Anti-friction Metals—			
"White Ant" brand ..	per ton	£42 to £62	..
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	8d.	..
j ,, 6 lea. Flax	per lb.	5½d.	..
j ,, 8 ply 10 lbs. Russian ..	per lb.	4½d.	..
j ,, 10 lbs. Russian, single ..	per lb.	4½d.	..
j ,, 180 lbs. Jute rove ..	per ton	£11	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£24 15	10/- dec.

Quotations supplied by Messrs.:—*a* G. Boor & Co.; *b* The British Aluminium Co., Ltd.; *c* Thos. Bolton & Sons., Ltd.; *d* F. Wiggins & Sons.; *e* Frederick Smith & Co., *f* India-Rubber, G.P. and Teleg. Works Co., Ltd.; *g* James & Shakspeare; *h* Edward Till & Co.; *i* Bolling & Lowe; *j* Walter H. Hindley and Co., Ltd.; *k* Morris Ashby, Ltd.; *m* W. T. Glover & Co., Ltd.; *n* P. Ormiston & Sons; *o* Johnson, Matthey & Co., Ltd.; *p* The Phosphor Bronze Co., Ltd.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Br'h. Elec. Trac. Co.

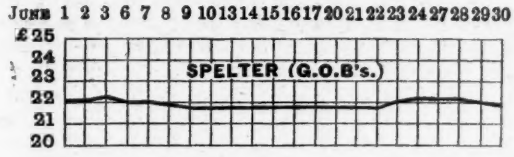
Locality.	Week ending	Receipts for the week. £	£*	No. wks.	Total to date. £	£*	Miles open.	*
Aberdeen	July 2	1,417	+ 60	5	7,468	+ 1,217	10	—
Birmingham ..	,, 2	5,855	+472	27	138,370	+ 8,312	8½	—
Blackburn	,, 1	990	+ 90	14	13,370	+ 989	13½	—
Blackpool	June 30	966	+ 19	13	11,400	+ 548	8¾	—
,, —Fleetw'd	July 2	793	—106	27	9,992	— 633	7¾	—
,, —Lytham	June 30	558	+ 95	25	8,763	+ 5,740	7¾	—
Bolton	,, 26	1,855	— 82	13	23,795	— 186	25	—
Bournemouth ..	,, 29	1,044	+ 44	13	14,206	—	10½	—
Bradford	,, 25	4,506	+549	12	56,300	+ 9,723	50	—
Brighton	July 3	1,189	+208	—	12,666	— 9	—	—
Bristol	,, 1	5,385	+ 9	—	—	—	28	—
Devonport ..	June 24	682	+178	25	12,650	+ 2,080	5	—
Dudley—Sto'rb'ge	,, 24	888	— 3	25	20,417	+ 719	18¾	—
Gateshead ..	,, 24	1,154	+ 34	25	22,289	+ 1,059	10½	+ ¾
Gr'n'k—Pt. Glsgw	,, 24	664	— 10	25	13,170	+ 621	7¾	—
Oldham—Ashton	,, 24	556	— 56	25	13,330	— 749	8	—
Potteries	,, 24	1,569	+134	25	41,996	+ 3,486	28½	—
Southport	,, 24	335	+ 12	25	7,407	+ 388	5½	—
South Staffs. ..	,, 24	723	—227	25	19,427	— 1,169	21½	—¾
Swansea	,, 24	534	— 15	25	12,718	+ 801	5¼	—
Wolverhampton ..	,, 24	413	+ 19	26	9,352	— 203	10½	+8
Yorks. Wool Dist.	,, 24	642	+271	25	14,842	+ 6,223	6	—
Miscellaneous ..	,, 24	3,906	—	25	71,277	—	—	—
Burnley	July 2	1,113	+818	—	—	—	10½	+8½
Burton-on-Trent ..	,, 3	375	—	13½	4,614	—	6½	—
Cardiff	June 25	2,095	+ 35	12	25,253	+ 985	14	—
Chatham & District	,, 30	688	— 76	26	14,533	+ 1,989	9·58	—
Cork	,, 30	551	— 76	26	11,382	— 910	9	—
Dover	,, 25	252	— 16	25	4,818	— 253	3	—

* Compared with the corresponding period of 1903.

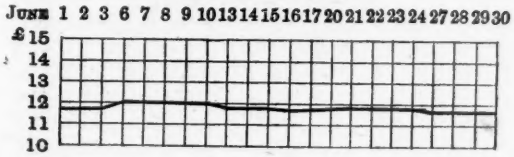
Locality.	Week ending	Receipts for the week. £	£*	No. wks.	Total to date. £	£*	Miles open.	*
Dublin	July 1	5,622	—146	27	123,736	+ 3,154	47	+ ¾
East Ham	,, 2	756	— 16	13	10,259	+ 974	5	+ ¼
Glasgow	,, 2	15,352	+1215	5	69,659	— 261	71½	+6½
Halifax (2 weeks) ..	June 29	3,214	+ 74	13	19,512	+ 1,147	33	+1½
Huddersfield ..	,, 18	1,312	+182	11	—	—	28	—
Hull	July 2	2,240	+346	13	28,418	+ 3,276	13	+2½
Ilkeston	June 29	153	— 66	13	1,918	—	4	—
Ipswich	July 2	588	—	13	6,507	—	10½	—
Isle of Thanet ..	,, 2	990	—108	26	11,188	— 320	10½	-
Leeds	,, 2	6,273	+237	—	61,637	+ 4,597	81½	+2
Liverpool	June 25	10,674	—100	26	258,912	+ 5,585	108	—
London C. C. ..	,, 25	13,400	+2186	13	143,602	+24,317	897	—
Manchester	July 2	12,918	+242	13	159,819	+ 3,702	131½	—
Newcastle	,, 2	3,421	+164	—	—	—	17	—
Portsmouth	,, 2	2,240	+ 37	—	26,180	+ 2,207	14½	—
Salford	June 27	4,060	— 99	—	51,627	+ 4,498	30	—
Sheffield	July 3	4,788	— 9	14	66,561	+ 1,908	33	+5½
Southampton ..	June 16	906	—221	—	—	—	9	—
Southend-on-Sea ..	,, 29	427	+ 21	13	4,213	+ 320	6½	—
Sunderland	,, 26	1,361	— 44	12	15,630	+ 348	20	+1
Tyneside	,, 29	627	+171	26	9,502	+ 1,718	8·9	+·4
West Ham	,, 23	1,132	—	17	12,115	—	8	—
Wolverhampton ..	,, 29	748	+251	—	—	—	9·5	—
Cen. London Rly. ..	July 2	6,476	—312	27	178,243	— 2,506	6	—
City & S. Lon. Rly.	,, 3	2,511	+ 56	1	—	—	6½	—
Dublin—Lucan Rly.	June 30	250	+ 88	26	2,973	+ 297	6½	—
G. N. and City Ry.	,, 18	890	— 18	18	16,659	—	3½	—
L'pool Overh'd Rly.	July 3	1,669	+ 17	28	42,909	+ 60	6½	+4½
Mersey Railway ..	,, 2	2,033	+720	26	29,596	+ 8,231	4½	—

METAL MARKET.

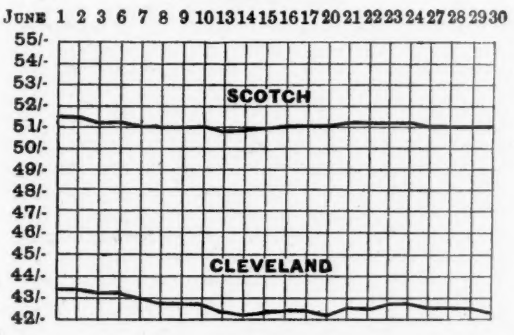
Fluctuations in June.



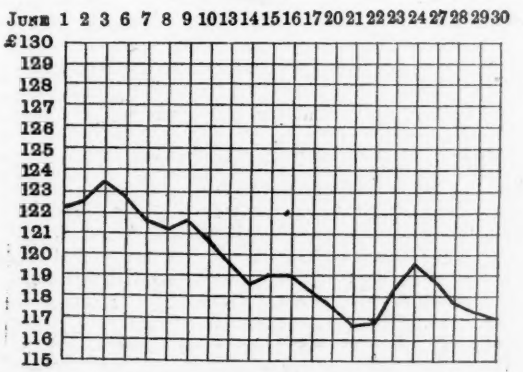
LEAD (ENGLISH).



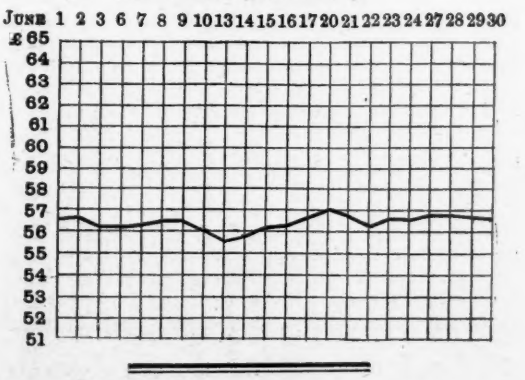
IRON.



TIN.



COPPER (G.M.B's.)



Warrington.—The T.C. is applying for a further prolongation of time for the construction of the tramways in Pudgate Lane and Manchester Road.

THE LORAIN SYSTEM ON ITS DEFENCE.

Wolverhampton is to be congratulated on the possession of an electrical engineer who makes its cause his own, and has the courage of its opinions. Theoretically he is, as an engineer, without a brief for either system: actually he is in the position of an expert witness called by the Wolverhampton Corporation; and, even if he were not sincere, as we believe him to be, he would have to earn his fees. But the most experienced ("hardened" almost slipped from our pen) expert witness cannot save a case which is founded chiefly on shadows, dress them how he will, and although we may admire Mr. Shawfield's temerity in exposing surface-contact systems in general, and the Lorain system in particular, to renewed fire, we feel that his own artillery ought to have been heavier if he desired to force an engagement.

That was our feeling on first reading the clearly-written paper read before the M.E.A. on June 29th, and the feeling has strengthened on further study of the case for and against.

Let it be understood, before proceeding, that we do not oppose contact systems from any blind adherence to overhead wires. We believe that our opposition has been justified in the past, and we hope to show that ample justification still exists for the attitude we have taken with respect to surface-contact systems as a class. Circumstances made it necessary to direct our criticisms against one system in particular, because it was the only one alive at the time, and we desired to do our duty towards the unconscious ratepayers of Wolverhampton; but, practically, all we have said in the past, and what we shall say below, is applicable to every surface contact system at present on the market. The overhead system has potentialities for danger which we would be the last to deny, but these potentialities exist in other forms in every contact system, and, while accidents due to falling wires and failing insulation have been extremely few, considering the number of miles of overhead construction in use, they are decreasing to vanishing point as constructional methods improve, as more attention is paid to insulation and to earthing, and as message wires and their attendant guard wires are removed from an undoubtedly menacing proximity to the trolley wires.

But our stand in favour of the trolley system has been almost wholly taken on the ground of economy—economy in capital cost, which should be as the sound of a fountain in the desert to local authorities in these tight times, and economy in continuing cost, which should be an equally glad sound to the be-rated citizens of most English towns. That claim of the overhead system of economy over every other system has not yet been disallowed, and, in fact, is made more sure by the paper which is abstracted in another part of this issue.

We shall never put economy before safety, but we maintain that up to the present no demonstration of the superior merits of any surface-contact system on the latter count has been given.

In this matter of the Lorain system in Wolverhampton, we are pleased to record that our advice has been proved sound in the sequel; that it was not accepted is not our loss, but Wolverhampton's, and we fear that the depopulation of that town will not be checked by the adoption of a system of which the only recommendation is that it is more sightly than the overhead system. Of that greater sightliness there is no doubt, and we suppose that if the majority of the inhabitants of a town prefer to pay an exorbitant price in order to avoid getting used to poles and wires, nobody must say them nay.

Mr. Shawfield quite correctly discusses the Lorain system, first of all from the point of view of safety, and produces a table showing that 59 studs have been found alive at over 50 volts on about 11 route miles during the year. In view of this figure, and the following statement that the only victims during the year were a sheep and a dog, this sentence takes on a two-edged appearance:—"That instances of falling wires and live poles do occur with startling frequency . . . is undoubtedly true, and that these mishaps are not more frequently attended by injury to human beings or animals, appears to the author to be largely due to the beneficent interposition of Providence."

In the same way that Mr. Shawfield's extenuation of live studs applies equally to live poles, on the ground that 500 volts does not always mean danger, because of the high resistance nature of the fault, so is it no more wonderful that falling wires and live poles should cause injury to living things as seldom as live studs. Indeed, it is less wonderful if the various circumstances are considered.

We would remind our readers that Mr. Shawfield, when comparing the dangerous qualities of the two systems, is really putting his dozen miles of Lorain track into relief against the 3,000 miles of trolley, and that the whole of the overhead accidents to which Mr. Shawfield refers as occurring in the network of tramways surrounding Wolverhampton were due to antiquation, these particular tramways having been electrically equipped six years ago, when "flexible suspensions" and adequate double insulation were unknown.

We have been seeking information about the more modern tramways in the immediate neighbourhood of Wolverhampton, and find that during the two years and over, that these lines have been open, there has not been a single instance of a live pole. The double insulation has never broken down, and the insulators are tested only once a month (except in the centres of the towns) instead of every day as on the Lorain system. For the year 1903 only 63 car-miles were lost on the 14 miles of this system owing to defective overhead work, and 23 miles of that loss were due to a section feeder-cable. The only personal injury ever caused on this system by construction peculiar to the overhead system was brought about by a trolley standard breaking.

On the larger system adjoining, although the failures of single insulation were rather frequent for a month following the extraordinary rains of last winter, only one was responsible for shock to animals or persons, and we are informed that only three miles in every 10,000 miles run were lost during 1903 from accidents due to the overhead construction, while no more than 2·5 *per cent.* of that small loss was caused by a trolley wire falling, the whole of the remainder being due to guard wires. Another large undertaking of the same age, and suffering from the same drawbacks of single insulation, and much guard wire on the older sections, kindly informs us that overhead failures during 1903 were responsible for a loss of 2½ miles per 10,000 run, while a small interurban line, equipped with single insulation in a pure atmosphere, and with wire standards and trolley poles of a more than usually flexible build, thus tending to reduce the blow of the wheel on the insulator, states that only 21 miles were lost throughout the year owing to accidents to trolleys or overhead gear, and that loss was all on account of a short-circuit at the top of a trolley pole.

The other figures do not include accidents to trolley poles and gear, but we understand that the mileage lost on that account is relatively unimportant.

We maintain, therefore, that Mr. Shawfield has not only failed to make out his case for the contact system on the score of safety, but also on the score of reliability, although there is no doubt that the efforts of the whole of his staff have been concentrated on securing a particularly favourable result.

Now that the B. of T. has secured data relating to electrical accidents on tramways, we hope that it will see its way to make public a digest of the information, for we are confident that serious accidents bear a ridiculously trivial proportion to the miles run.

The fact that, in spite of ceaseless testing, an average of five to six studs per mile of track per annum became alive, is by no means a recommendation of the system, and we think that live poles to the same extent would merit the attention of the B. of T.

The small number of miles lost owing to damaged skates speaks well for the laying and maintenance of the track. It is lucky that mining subsidences do not occur on the Lorain sections. It would be absolutely impossible to use this system on the neighbouring tramways, where every route boasts a subsidence or two which soon alter the contour of the track. There it is no uncommon thing to see the road raised from 2 to 6 ft. at a time to make up for the subsidence of a few months.

The one absolute essential to the proper working of the Lorain system is the perfect alignment of the paving, and we believe, as we have stated in previous articles, that the item of expenditure under this head will grow to excessive proportions with the age of the undertaking.

Mr. Shawfield regards the surface-contact system as equivalent to an underground trolley wire divided into independent 10-ft. sections, and compares it with the overhead trolley wire divided into half-mile sections, greatly to the disadvantage of the latter in case of breakdown; but surely he has overlooked the fact that all up-to-date lines are equipped with separate trolley wires for up and down traffic, and if one breaks down the other is still available as a makeshift, even with single track. On a double track system, of course, there would be even less difficulty.

When Mr. Shawfield comes to the cost of operation and maintenance, he simply admits that there is nothing to beat the trolley, and that it does not pay for municipalities to dabble in experiments. This is very straightforward, and must be a great blow to Wulfrunians.

The Lorain track equipment already costs ·11d. per car-mile, and we cannot share Mr. Shawfield's opinion that this is a reasonable figure. When criticising his 1903 report, we took exception to the abnormal figure taken as the cost of maintaining overhead work, and we have found no reason in the meantime to withdraw what was written then (Elec. Review, April 17th, 1903).

We have been favoured with the costs relating to the maintenance, inspection, and repair of the overhead construction of two undertakings in the neighbourhood of Wolverhampton, and they do not approach ·11d. per car-mile. Similarly the cost of maintaining that portion of the car equipment peculiar to the Lorain system has been enormous when compared with the equivalent item of repairs to trolley heads, wheels, poles, and standards on the same lines.

Taking the highest figures in each case, we estimate that Wolverhampton would have had over £300 more net profit for the year if the cars and track had been like other folk's cars and tracks. But that is not taking into account the amount which might have been saved in the cost of energy.

Mr. Shawfield estimates the extra energy called for by the system to be ·24 unit per car-mile, and this on the previous basis of 600,000 car-miles per annum at 1·65d. per unit, which used to be the price charged by the Lighting Committee to the tramways, means further reduction by £100 of the revenue available for starting a fund for the replacement of the system.

Put in its most simple form, this extra expenditure involves Wolverhampton in a yearly sacrifice of 1½ per cent. of its tramway revenue to the god of cussedness. What it will involve later no one knows.

Then, again, the surface-contact system has to be paid for to a pretty tune before it will work at all. Wolverhampton has powers to construct 9 miles of double line and 4 miles of single line (Garcke's Manual), making altogether 22 miles of track. Basing the cost of each on Mr. Shawfield's figures, but taking the higher estimate for the overhead system, and the lower for the Lorain, it is seen that the overhead equipment of this length would cost £26,000, while the surface-contact work would run to £44,000, a difference of 60 per cent., and an additional capital charge, at 3½ per cent., of £630.

Although we do not think that for a town like Wolverhampton (which, although the most presentable town in the Black Country, is by no means a pleasure resort), the relative importance of capital cost and appearance is expressed fittingly in the ratio of ½ a page to 2½ pages, yet we agree with Mr. Shawfield, as everyone must agree, that a poleless system is almost infinitely less offensive to the eye than a poleful system, and that centre poles are extremely objectionable as obstructions to all kinds of traffic, except where the streets are very wide, and division of up and down traffic is desired.

Finally, we think that the paper forms the weightiest condemnation of the surface-contact system which has appeared, and the author is to be sincerely congratulated on performing a public service in thus warning other local authorities against the slough in which poor Wolverhampton is wallowing.

A fashionable watering place is the only place to which the surface-contact system is adapted, and there are many examples of such resorts being served by the vulgar trolley with a surprisingly small degree of disfigurement.

REVIEWS.

The Grant and Validity of British Patents for Inventions. By James Roberts, M.A., LL.B., Barrister-at-Law. London: John Murray. 1903. Price 25s. net.

In writing this book, one of Mr. Roberts's objects appears to have been to provide inventors with a work of reference wherein they can ascertain the practice of the Patent Office, which must be stringently observed by those who seek protection for their inventions. He also sets out the principles of law which have to be applied in order to ascertain whether an invention is likely to prove good subject matter for a patent or no, and the rules which guide the Courts in the settlement of that all-important question: Is this the true and first inventor? The work is addressed specially to inventors.

The first part is devoted to general treatment of the law and practice relating to letters patents. Here the inventor may study the rules of law which may be necessary to assist him in deciding whether it is worth his while to have a patent sealed in his favour. The principles deduced from a number of cases are set out in large type; but to meet the case of an inventor whose legal acuteness may be deficient, each "principle" is followed by an epitome of the case from which it is deduced. Let us take an example. At p. 21 it is stated (in effect) that prior user invalidates a patent. The following illustration is given (amongst others):—"In the case of a patent for bleaching, it was proved that a bleacher had for five or six years previously used the same process commercially, but kept it a trade secret, known only to his partners and two servants; the patent was held invalid (Tennant's case, post p. 182)."

He who desires to know more about Tennant's case, will find a good abstract of the report thereof if he turns to p. 182. Again, at p. 62, it is pointed out that a claim in a specification may be wide if the invention itself be such a new application of newly discovered principles as to justify it. Illustration: "The first successful electric glow lamp produced a new industry. The claim for the lamp, the combination of the filament, the glass receiver through which pass the leading wires, and the vacuum, includes all lamps, although made by means other than those mentioned in the specification (Edison *v.* Woodhouse). As a general rule, more than one illustration is given, in order that the inventor may see the application of the principle in question to chemical, electrical, mechanical, or other patents.

In dealing with the question of opposition to the grant of letters patent, the author goes very fully into the second and most important ground of opposition, namely, that the invention has been patented in this country on an application of prior date. He points out (at p. 141) that with regard to what are known as "specific references":—"The position on the whole, is that in questions raised in opposition to the grant, no amendment can be required, or general or specific reference, unless the applicant's claim appropriates something that is already the subject of a claim in the earlier patent." We venture to draw attention to this passage as a statement of existing law, in spite of the fact that under the Patent Act, 1902, when that measure comes into force, it will be within the power of the Patent Office to make a grant subject to a reference to earlier inventions. It is obvious that if every patent issued were required to contain references to similar inventions, the work of the Patent Office under the new Act would be greatly facilitated. To avoid this, inventors should, therefore, have a clear appreciation of their rights, as nothing tends to lessen the value of a patent so much as a reference to an earlier invention of which it may be thought to be an infringement.

Mr. Roberts's work also contains "Abstracts of leading and illustrative cases." These abstracts are constantly referred to in the earlier portion of the work, in illustration of the propositions of law inserted in the text. In his introduction to the abstract, the author explains that confusion has often arisen in the law of letters patent, owing to the tendency of judges to rely too implicitly upon *dicta* which appear in former cases. It is too often assumed that a *dictum* is a statement of a general principle. The authority of each case must be gauged with reference to the facts upon which it was decided. In these circumstances the author has epitomised a large number of cases which have come before the Courts since 1785. Where necessary, explanatory notes are added, and references are given to later decisions in which the case abstracted has been relied upon. These notes should prove most useful to members of the legal profession. Cases which cannot be understood by mere verbal statement are illustrated by diagrams, mechanical patents being described by means of the plans which accompany the original specification, and chemical patents being illustrated by the necessary formulæ. As a general rule, the execution of the diagrams leaves nothing to be desired, but we must confess to having had difficulty in understanding some of the abstracts even with the aid of the diagrams. Each case, however, will doubtless be capable of interpretation by any inventor who may be working on the same lines. Amongst electrical cases we might mention Chamberlain & Hookham *v.* Mayor, &c., of Bradford, which it would be impossible to understand without diagrammatic representation of certain electric meters, the merits and construction of which were discussed in Court. The work concludes with the text of the Patent Acts, a schedule of forms, the "Circular of Information," and a full index. The name of the publisher is a sufficient guarantee that the printing and make-up leave nothing to be desired.

The Management of Electric Tramways and Light Railways. By Wm. R. Bowker. London: E. & F. N. Spon. 1904. 9s. net.

This book contains much wisdom, but not much of it belongs to the "author," as he delights to call himself, without much excuse for the assumption of the title. Authorities there are in plenty, but very little author; and, in truth, the little there is makes us particularly thankful that there is no more, so badly equipped for the part is he for the authorship of such a work.

It annoys us especially to think that while there is a clear place for an original and comprehensive treatise under this title—at the very time when a pressing need for a standard work exists—such a stone should be put before us.

The book contains 284 pages, and, incredible as it may seem, no more than 80 pages can be attributed to the individual who puts his name on the cover. Nearly 80 per cent. of the reading matter (and, we may add, 100 per cent. of the readable matter) has been transplanted. What a book of 280 pages, entirely by Mr. Bowker, would be like, we shudder to think, for the little there is by him in this nine-shilling volume, is enough to set the teeth of an army on edge.

On p. 40 the "author" says "the following details are taken from McColl's 'Tramway Accounts Book,'" and nine whole pages taken right out of that book follow, but no mention is made of the fact that the three preceding pages are taken from the same source. In the same free-and-easy way the reader's attention is not drawn to the authorship of pp. 125 to 128 on Competition, which, although elementary enough, are written in English (and for that reason alone are assuredly not original). Immediately following is a simple and concise, but irrelevant, article on the railway clearing house, occupying six pages, without a footnote acknowledging the real author.

The Review is too much flattered by Mr. Bowker in that he has done us the honour to reprint in full the following:—

Pages 50 to 67, "Light Railways and Land Development," by Hewitt and Rhodes. (May 16th and 23rd, 1902.)

Pages 68 to 90, "Carriage of Merchandise on Electrical Tramways and Light Railways," by T. Upton. (August 14th, 21st, and 28th, 1903.)

Pages 204 to 214, abstract of Mr. Bowden's report, as auditor to Newcastle Corporation, on the financial position of the tramway system. (July 31st, 1903.)

Pages 221 to 228, Editorials on the Accounts of Bradford, Sheffield, Southport and Wallasey electric traction undertakings. (January 1st, 1904, and January 15th, 1904.)

Pages 241 to 248, summaries of tramcar specifications for Croydon, Ilford and the L.C.C. (February 7th and 14th, and March 7th, 1902.)

This is a total of 63 pp. or so, which have helped towards the title of "author" assumed by Mr. Bowker. Fifteen pages are due to Sir George Findlay; 31 are occupied by Mr. Young's report on season tickets; six by Mr. J. B. Hamilton's "Report on Workmen's Fares," while 23 pages are filled with Board of Trade regulations, statutory rules and orders, bye-laws, and the rest of the official matter which never fails to re-appear in a publication of this nature.

As may be imagined, there is no definite scheme about the book; it is merely a disconnected patchwork of articles or reports which are either in the possession of everyone already, or to which ready access can be obtained.

Mr. Bowker's language is nothing if not slipshod. Examples, amusing enough if one is in a good temper, but very painful otherwise, appear in every one of the few pages which, we imagine, can be due to none other than his pen. "The position and duties of the general manager come under a commercial or financial heading rather than from an engineering standpoint." "Having this information at his commands, he very easily discovers any weakness which may possibly arise from time to time . . . . and remedy the cause, *if any*." The whole sentence would discredit a schoolboy, but the addition of the last two words makes it positively humorous.

Again—" . . . . or they can do otherwise, which consists in trying impracticable methods . . . . " "In carefully perusing and studying these reports, it strikes one very forcibly, as regards the different ideas, opinions and results arrived at by different managers and committees. Everything seems complicated, with no approach at unanimity as regards either for or against the adoption or otherwise."

That is nothing but Babu.

Then the wisdom of the man!—"From a practical and financial standpoint, the secret of passenger traffic organisation is to place the cars where the passenger traffic demands it." That is the secret of passenger traffic, and we are presented (all for 9s.) with the companion key to goods traffic. "The secret of the handling and organisation (from a commercial standpoint) of an extensive goods traffic is to prevent the rolling stock from coming back empty, or, in other words, minus goods on the return journey." If the gifted author were not so far removed from the commonplace, he would not have deigned to supply an alternative reading to a difficult passage, and his readers might never have realised what an empty truck was like.

Our traffic managers are not to be allowed to build up the traffic on a quiet line, for "it is obvious, that to run so large a service as to bring the receipts per mile below the average required to pay all working expenses and fixed charges, and to provide for depreciation and reserve, would be unwarrantable."

Finance is the "author's" strong point. "The fact must not be lost sight of, that a certain percentage of the revenue receipts is required for maintenance expenses, and the great object should be to keep this expense to the lowest possible limit."

There need be no further trouble in the matter of delimitation of duties, for we have it on Mr. Bowker's authority, that "the chief duty of the ticket inspector is to inspect tickets . . ."; and, moreover, "the chief duty of the motor inspector is to inspect . . . motors . . ."

The title page informs us that Mr. Bowker does not confine himself to commercial matters, but has guided the public in electrical engineering through the medium of a book entitled "Dynamo, Motor and Switchboard Circuits for Electrical Engineers," and he gives a sample of his qualifications for such a work when speaking of the motorman:—"There is controlled and kept in check, by the simple controller-handle, practically an unlimited amount of electrical energy, which if once out of control . . . . would probably hurl into eternity dozens of lives." No wonder that the motorman "should possess all round qualifications applicable to the position he holds."

We must add that Mr. Bowker's knowledge of contemporary tramway history is as weak as his composition, for in a note written "since going to press," this sentence occurs:—"For the mutual protection of 'municipal' tramway undertakings, the Author thinks that a 'Municipal Tramways Association' should be formed at the earliest possible date."

THE MUNICIPAL ELECTRICAL CONVENTION.

In our last issue we referred to the opening proceedings of the Incorporated Municipal Electrical Association, which took place at Derby, on the 29th ult.

The first paper, by Mr. Shawfield, founded upon his varied experiences of surface contact tramway working at Wolverhampton, did not add much to our stock of knowledge on that subject; and, strangely enough, the one engineer who might have been expected to exhibit a "fellow feeling," ruthlessly destroyed his brother engineer's "cherished ideal."

Mr. Cridge's paper was probably worthy of a better fate than that which befell it; it described a system, where usually there is none, and but for the approach of the luncheon hour would have received much more attention than it did.

The afternoon visit was to Haddon Hall or to Chatsworth, thanks to the hospitality of the Mayor and Corporation of Derby, a special train being provided as far as Rowsley, whence brakes took the parties to their respective destinations. The weather was all that could be desired, and the excursions were greatly appreciated.

The parties again embarked, and after a lengthy drive through Derbyshire scenery, enlivened at a halfway house by the inevitable itinerant musician, whose efforts were only suspended on the judicious application of pennies into the interior of his trumpet, arrived at Matlock Bath, where, at the Pavilion, tea and strawberries awaited them; the evening was spent among the various attractions of the neighbourhood.

Thursday morning found the members at Nottingham, the meeting being held at University College. They received a cordial welcome from the Mayor, Mr. Alfred Page, Sir J. Turney, and other members of the Corporation.

Mr. S. L. Pearce, chief electrical engineer, Manchester, read a paper on the "Equipment and Working of Polyphase Sub-stations," which excited considerable interest, and drew from Mr. Ferranti a well-merited protest on the score of the numerous complications to which present-day methods give rise. Mr. Ferranti referred to the severity of gas competition, a result largely due to the simple and efficient method of distribution adopted.

The next paper was by Mr. H. Faraday Proctor, chief electrical engineer, Bristol, who contributed some brief notes on the recent fire at his works, accompanied by lengthy apologies for reviving a subject with which everybody was probably familiar. The discussion disclosed so many ways in which the fire might have happened, that we felt a certain consolation in not being either a chief engineer with switchgear to buy, or a contractor with switchgear to sell. It served to emphasise points, which are, or should be, well known to engineers, viz., that fuses are unreliable, and should not be used for large powers; that switchboards and their surroundings should be incombustible and easily accessible.

After lunch the members visited the generating stations and carsheds of the Nottingham Corporation, the Nottingham Exhibition, and the works of the Brush Electrical Engineering Co., at Loughborough.

In the evening the annual dinner of the Association was held in the Mechanics' Institute, and in addition to the customary toasts proposed by the President, those of the "Corporations of Derby, Nottingham and Sheffield," proposed by Mr. J. H. Rider, and replied to by the Mayor of Derby; and the "I.M.E.A.," proposed by Mr. W. L. Madgen, and replied to by the President, were also honoured. The dinner was followed, after a considerable interval, by a somewhat visionary smoking concert, in regard to which the numerous absentees were to be congratulated.

On Friday the City of Sheffield was visited. The Lord Mayor, Councillor J. R. Wheatley, J.P., in an excellent speech, welcomed the convention at the Town Hall, where the meeting was subsequently held.

The first paper was read by Mr. R. S. Downe, of Southport, and dealt with the very important subject of Boiler House Economics, a subject which excited considerable discussion and many divergent opinions. The paper was, however, useful evidence that the boiler house is now receiving a larger share of the attention, which has heretofore been lavishly expended on the electrical plant.

The final paper of the convention was by Councillor Blakeway, chairman of the Electrical Committee, Southampton, on the "Financial Position of Municipal Electrical Undertakings," and was, in effect, a plea for increasing the price of energy in certain directions. Unhappily for the author (and, incidentally, for many others), brother councillors, too numerous to mention, proceeded metaphorically to pulverise his arguments, and had it not been for the proximity of lunch, it is somewhat difficult to imagine how the torrent of civic eloquence would have been stemmed.

The afternoon was devoted to visits to Mr. Fedden's fine new power station at Neepsend, the tramway station at Kelham Island, and to Messrs. Hadfield's steel foundry at Tinsley.

The latter visit offered many attractions, and the attendance was numerous. The firm employ some 4,000 hands at their works in Sheffield, which cover some 80 acres. The steel foundry at Tinsley is claimed to be the largest in the world, covering an area of some six acres, and is equipped with 20 overhead electrical travellers and 13 electrical jib cranes. Electricity plays an important part in these works, as a generating plant of over 2,000 H.P. supplies energy to 225 motors of from ½ to 150 H.P., and 400 arc lamps, scattered about the works.

The visitors spent a busy two hours in inspecting the various departments of the works, and were greatly interested in the extensive railway junction for Aberdeen Harbour, and numerous examples of a similar character in connection with the tramways of Glasgow, Birmingham, Johannesburg, Paisley, Ballarat, &c., which were on view in the lay-out department.

Perhaps the most interesting event was the firing of Hadfield's capped and uncapped shells against a section of hard-faced armour plate. The shots were electrically fired from a 4½ in. Krupp gun at about 40 ft. range, with a muzzle velocity of some 1,900 ft.-secs., and served to show the efficacy of the soft-capped projectile, which easily penetrated the plate, while the uncapped variety was shattered into fragments. We gathered that a great proportion of the projectiles supplied to the Navy are of Messrs. Hadfield's make.

Visitors would probably notice the extensive use of the emery wheel for cleaning up the numerous manganese steel castings for use in connection with tramways and general engineering work, in which the firm has always specialised.

The visit was brought to a close in the tea-room, where the President, ably seconded by Mr. J. H. Rider, expressed the gratitude of the members for an enjoyable afternoon, Mr. R. A. Hadfield suitably responding.

On Saturday the business meeting of the Association was held at Derby, when the following officers and Council for the ensuing year were elected :—

Officers and Council for 1905.

President—

* F. A. Newington, Edinburgh.

Vice-Presidents—

† R. A. Chattock, Birmingham; and S. E. Fedden, Sheffield.

Past-Presidents—

J. H. Rider, J. F. C. Snell, and T. P. Wilmshurst.

Council—

J. K. Brydges, Eastbourne
*Ald. Bruce, Sunderland
*W. A. Chamen, Glasgow (Past-Pres.)
J. Christie, Brighton
A. S. Giles, Blackburn
H. Kilgour, Cheltenham
V. H M'Cowen, Belfast
†Cr Panton, Bolton
*S. L. Pearce, Manchester
H. Faraday Proctor, Bristol
*Cr. Sinclair, Swansea
†Ald. J. P. Smith, Barrow-in-Furness
H. Talbot, Nottingham
*Bailie Willock, Glasgow
*G. Wilkinson, Harrowgate

Hon. Solicitor—

†Ald. G. Pearson, Bristol

Hon. Treasurer—

†J. H Rider, London

Hon. Secretary—

†J. E. Edgcome, Kingston-on-Thames.

* New names. † Re-elected.

It was decided to hold the 1905 Convention at Edinburgh.

The annual report and balance-sheet were adopted; from the former we gather that the total membership is now 385.

Other matters contained in the report were the Associates' prize scheme, superannuation of municipal officers, the work of the Parliamentary Committee, I.E.E. Wiring Rules, in which attention is drawn to an apparent discrepancy in clauses 12 and 29; conditions of supply and membership.

A discussion took place upon the provisions of the Supply of Electricity Bill which is being introduced by the Board of Trade; it was decided that Alderman Pearson, Bristol, should give evidence if thought desirable. Subsequently the question of extending the membership among the eligible members of the numerous municipal staffs was introduced, and with this object a resolution was passed repealing articles 10, 11 and 12 of the articles of association and subsituting the following :—

Members.

10. Every Member shall come within one of the following descriptions :—
(*a*) The Member shall, at the time of his election, be the chief electrical engineer engaged on the permanent staff of an electrical undertaking owned by a local authority, or the chief assistant or head of any engineering department in connection with such an undertaking of an actual or constructing capacity of not less than 5,000 kw.
(*b*) The Member shall be the Committee appointed by a local authority to have control over a municipal electrical undertaking within the area of such local authority, and shall be represented as regards its qualification to vote by one member of such Committee.

Associate Members.

11. Every Associate Member shall, at the time of his election, be an electrical engineer engaged on the permanent staff of a local authority, in a position of responsibility, in the capacity of assistant in connection with an undertaking having a plant capacity of at least 2,000 kw.

Associates.

12. Every Associate shall be an electrical engineer engaged on the permanent staff of a local authority, in a position of responsibility, in connection with an undertaking whose plant capacity does not exceed 2,000 kw.

COMMERCIAL PRACTICABILITY OF ELECTRIC TRACTION BY SURFACE CONTACTS.

By C. E. C. Shawfield, A.M.I.E.E., M.I.Mech.E., Borough Electrical and Tramway Engineer, Wolverhampton.

(*Abstract*).

As the author has had charge during the past 2½ years of the only surface-contact system of electric traction in commercial operation in Great Britain, he has ventured to place some of his experiences and the conclusions he has deduced therefrom on record.

After detailing various matters of history relating to the Wolverhampton system and controversy, the author proceeded to compare the respective merits of the overhead system and the surface-contact system from the following standpoints :—

1. Safety to human beings and animals.
2. Reliability of operation.
3. Cost of operation and maintenance.
4. Cost of installation.
5. Disfigurement of streets and obstruction to traffic.

Safety.—In any electrical or mechanical system, probably the most important point to be considered is the safety of the general public.

In comparing the respective advantages from the point of view of safety of the overhead system and the surface-contact system, it is evident that only one source of danger need be seriously considered, namely, that of electric shock, as practically all other risks are common to all systems of electric traction. In the case of surface-contact systems it is evident that the only portion of the apparatus exposed to the public, from which a shock could under any possible conditions be obtained, is the metal stud in the centre of the track.

The actual value of this risk may best be estimated in the light of actual experience, and the author has therefore analysed the records of defective boxes during the past 12 months, and has extracted therefrom the following particulars.

Table I.—Defective Boxes Found During 12 Months ending March 31st, 1904.

Quarter ending.	Cups damaged by short circuits		Moisture in granite basin.		Total.		Average per mile of single track per annum.
	E.M.F. above earth, as shown on Weston voltmeter.						
	Volts 10 to 49	Volts 50 to 500	Volts 10 to 49	Volts 50 to 500	Volts 10 to 49	Volts 50 to 500	
June 30, 1903...	10	14	0	1	10	15	10
Sept. 30, „ ...	14	23	0	2	14	25	
Dec. 31, „ ...	12	6	2	0	14	6	
Mar. 31, 1904 ..	10	11	2	2	12	13	
Totals ...	46	54	4	5	50	59	

It will be seen from the foregoing table that a total of 109 boxes were found more or less alive during the 12 months in question, 59 of which were alive at an E.M.F. of over 50 and under 500 volts. The author divided the live boxes into two sections, namely, those under and those over 50 volts, as he has found by experiment that it is quite impossible for any person or animal to feel the slightest sensation of shock from a box which gives a reading of 50 volts or under, and it is only in rare cases that anything approaching a shock can be obtained from a box which gives a reading of less than 100 volts.

It will be noticed that out of the total of 109 defective boxes, in nine cases the trouble was due to moisture in the granite basin, that is, to the accumulation of water on the surface of the granite basin under the dope, which formed a leakage path to the top-plate. This may be said to be due in every case to carelessness in fixing in the first instance, sufficient care not having been taken to see that the interior of the granite basin was thoroughly clean and well brushed over with a coating of hot dope before the remainder of the dope was poured in. The remaining 100 defective boxes were the result of damage done to the interior of the cups by heavy and repeated short circuits. These short circuits are caused by pieces of scrap iron which are picked up by the magnet system and come in contact at the same time with the collecting skate and with a cross rail at junctions and turnouts.

Recent experiments made by the author show that the degree of damage to the cup in the event of a short circuit entirely depends upon the time element of the circuit breaker controlling the main feeder. When the traction switchboard was installed at the power station, the possibility of the adoption of a surface contact system had not been considered by the Tramways Committee, and the circuit breakers for the tramway feeders were specially designed to give a comparatively slow break, with the object of preventing the rise of pressure which is frequently caused by the sudden rupture of an inductive circuit. Experience has shown, however, that this is the very worst type of apparatus that could have been selected for use with the surface contact system, as it allows the heavy current due to a short circuit to flow for a sufficient length of time to give rise to a considerable amount of arcing or flashing between the carbon contacts inside the cup, resulting in the charring of the latter and sometimes in the fusion of the copper ribbon. The author is now replacing the original circuit breakers with others of a new type, which give a more rapid break with magnetic blow-out, and as a result of experiment he has found that with the circuit breaker set to operate at 600 amperes, the tramway bus-bars may be short-circuited a large number of times in rapid succession through the contact making mechanism of the cup without the latter receiving any appreciable damage, and he has every reason to believe that this alteration in the type of circuit breaker will very greatly reduce the number of defective boxes in the future.

Instances of defective boxes due to short circuits are more frequent in the summer than in the winter months; light pieces of iron or

steel are more easily picked up by the magnet when the track is dry and dusty, than when it is covered with wet and sticky mud.

The presence of a metallic stud in the street surface electrically charged at a pressure of 500 volts above earth would, at first sight, appear to constitute a grave source of danger, but the author points out that in speaking of a stud being alive at 500 volts it does not necessarily imply that the stud is capable of transmitting a dangerous stock to any animal or person stepping thereon; as an actual matter of fact, this is by no means the case, as owing to the comparatively high resistance of the conducting parts formed by the charring of the interior of the cup, the *quantity* of current that can pass is exceedingly small, and, in many cases, the readings obtained from the same "live" stud by different voltmeters will vary enormously, a difference of one or two hundred volts being by no means uncommon, this variation being simply due to the difference in internal resistance of the respective voltmeters.

In only one instance has the shock received from a "live" stud been attended with serious results, and this occurred on February 17th, 1904, when a sheep and a dog were electrocuted through treading on a faulty box on the Tettenhall Road route.

Immediately after the accident to the sheep and the dog, and before any warning could be given, a horse attached to a butcher's cart stepped on the same box, and was brought down by the shock. It got up again immediately, however, and when examined shortly afterwards by a veterinary surgeon was reported as being none the worse for its adventure. As a result of actual experiments, the author is inclined to believe that horses, in spite of the fact that they are shod with metal shoes, are much less sensitive to a shock sustained by *stepping* on a charged metallic substance than to a shock received from a live conductor falling on them from above.

Several instances have occurred of horses stepping on boxes which, when tested with a Weston voltmeter, gave readings of 500 volts and over, and, although in the majority of cases the animals were brought down, in no case was there any resulting injury from the shock.

The author has on more than one occasion watched a pedestrian step on a box which he has known to be "alive" at a pressure of 500 volts, as recorded by a Weston voltmeter, but in all cases the individual was apparently quite unaware of the fact.

The comparative harmlessness of the shock received from studs "alive" at the apparently high pressure of 500 volts is, of course, due to the comparatively high resistance of the charred surface of the vulcabeston cup, and to the fact that there is never under any conditions of breakdown or defect any metallic connection between the top plate and the supply main.

In the case of the overhead system, it is evident that there is risk of electric shock from any one of three causes, namely—a fallen trolley wire; a fallen telephone, telegraph, span or guard wire; a pole which has become alive through the failure of the insulators.

Wolverhampton is situated in the midst of a network of tramways, all of which are operated on the overhead trolley system, and, judging by the frequent occurrence of accidents due to one of the three causes mentioned above, the author is of the opinion that the risk of electric shock from one of these causes is at least as great as that arising from the occurrence of a "live" stud.

The recent accident in a Midland town, whereby three horses were killed, and the man in charge thereof injured by a shock received from a tramway pole in the centre of the street, is a grim illustration of the fact that the dangers of the overhead system are by no means confined to falling trolley wires or charged telegraph wires.

On a large percentage of the tramway systems of this country centre pole or side pole bracket arm construction is largely used, and in accordance with the usual practice the poles are erected in concrete. It is well known that under certain conditions which may frequently occur in practice, these poles are virtually insulated from the general mass of the earth, and can therefore become charged at a high potential relatively to the earth. When it is considered that in a very large number of cases single insulation only is used between the trolley wire and the bracket arm, it is evident that failure of the straight line insulator which supports the trolley wire—either from mechanical stress or other cause—may result in a pole becoming "alive" at an E.M.F. of anything up to 500 volts, and prove a source of very serious danger to human beings and animals in the vicinity.

It is evident moreover that the failure of an insulator under the conditions named would not be easily detected under ordinary service conditions, and there would be nothing to indicate the fact that anything was wrong until an accident had occurred.

So far as the question of safety is concerned, the author is of opinion that the balance of advantage lies with a well designed and carefully installed surface-contact system.

Reliability of Operation.—Owing to the entire absence of any statistical information regarding the number of journeys lost through defects in or failures of the overhead electrical equipment on tramways where the overhead system is adopted, it is very difficult to institute anything like a comparison between the overhead system and the surface-contact system so far as reliability of operation is concerned.

(Mr. Shawfield shows in tabular form the total mileage lost due to faults in the electrical equipment of the Wolverhampton tramways during the 12 months ending March 31st, 1904.)

Out of a total of 173 car-miles lost due to defects in the Lorain surface-contact equipment during the period covered by the above table, only 27 are debited against the track equipment.

146 car-miles lost due to defects in the car equipment may be classified as follows:—

Table II.—Details of Miles Lost Due to Faults in Lorain Car Equipment.

—	June quarter.	S'pt'mber quarter.	Dec'mber quarter.	March quarter.	Total.
Earthed magnets...	22	21	16	20	79
Buckled skates ...	10	7	20	3	40
Battery faults ...	8	6	—	3	17
Other causes ...	3	5	2	—	10
	43	39	38	26	146

It will be seen that, during the period in question, the total number of car-miles lost due to defects in the electrical equipment of both cars and track averaged 3⅓ car-miles out of every 10,000 car-miles run, and, having regard to the fact that during the months of February and March there were frequent and heavy snowfalls, the author is of the opinion that this constitutes a record for regularity of service, which it is difficult to surpass.

In considering the car-miles lost due to the Lorain car equipment, it must be remembered that the defects which were the cause of the delays have a parallel in the case of the overhead system in respect of broken and damaged trolley wheels and trolley poles and in the earthing of the cables inside the trolley standard.

In considering the respective liabilities to breakdown of the rival systems, it should be borne in mind that in the case of the surface-contact system as installed at Wolverhampton, any accident or breakdown can only affect one, or, in very rare cases, two boxes, and the momentum of the car is sufficient to enable it to coast over the short length of track thus disabled. Further, any faulty box can be removed and replaced by a new one in an average time of 15 minutes without any interruption of service. It may in effect be said that the surface-contact system is equivalent to an underground trolley wire divided into 10-ft. sections, each of which is independent of the rest, and may be removed and replaced without interference with the efficient operation of the remainder. It is in this respect that the surface-contact system has, in the author's opinion, a distinct advantage over the overhead system, inasmuch as with the latter an accident of any kind to the overhead equipment usually means the putting out of service temporarily, of from a quarter of a mile to half a mile of route, and a total cessation of traffic along the section affected for a more or less lengthy period.

Another respect in which the surface-contact system possesses a marked advantage over the overhead system is that the conductors are free to devote the whole of their time to the collection of fares and to looking after the convenience and comfort of passengers.

As a result of the 2½ years' experience the author has had of the operation of a surface-contact system, he believes that for reliability of operation it has many and noteworthy advantages over either the overhead trolley system or the conduit system.

Cost of Operation and Maintenance.—This question must always be a determining factor in the choice of a system of electric traction, as under the present *régime* of municipal control, with its attendant low fares and high wages, it is becoming an increasingly difficult matter in many cases to maintain a tramway system as a paying concern, and consequently it is of great importance that the system of traction adopted should be one that will require the minimum annual expenditure to maintain it in a safe and efficient working condition.

It must be admitted at the outset that from the point of view of cheapness of operation and maintenance, no system of electrical traction can rival the overhead trolley system.

The following statement shows the expenditure on the maintenance of the Lorain surface-contact system at Wolverhampton during the 12 months ending March 31st, 1904:—

Table III. — Repairs and Maintenance Costs of Lorain System for 12 months ending March 31st, 1904.

Track Equipment.

	Total cost.	Cost per mile of single track.	Cost per car-mile.
Repairs and maintenance of cups and top-plates ...	£125 5 5	£11·3	0584.
Raising top-plates	5 19 2	0·5	·002d.
Miscellaneous repairs ...	12 2 1	1·1	·005d.
Inspection & testing of track	94 15 6	8·6	·044d.
	£238 2 2	£21·6	·11d.

Car Equipment.

Repairs and maintenance of magnet systems	£72 13 2	£3	·033d.
Repairs and maintenance of switches and batteries including charging	20 3 4	0·8	·009d.
Repairs and maintenance of collecting skates	115 11 8	4·7	·053d.
Inspection and adjustment of magnet systems and collecting skates	102 13 11	4·2	·047d.
	£311 2 1	£12·9	·144d.

The expenditure under the heading of track equipment the author considers to be very reasonable, and is of opinion that it will bear comparison with the cost of maintenance of any similar length of overhead equipment running in a busy manufacturing town.

The expenditure on the inspection and maintenance of the car equipment has been rather heavy, the items relating to the magnet systems and batteries being, in the author's opinion, abnormal, and considerably in excess of what may be expected in the future.

It is impossible to obtain reliable figures as to the cost of inspection and maintenance of the trolley wheels, trolley poles and standards in the case of the overhead system, as records apparently are not kept separately of the expenditure incurred in these respects, but it is probable that the car equipment of the overhead system can be more cheaply maintained than that of a surface contact system.

One of the most serious disadvantages of the surface contact system is the increased consumption of electrical energy involved. The additional quantity required varies according to the type of surface contact system adopted, but with practically every type of system there are three causes which must involve additional current consumption, and these are as follows:—

Firstly—The energy required to operate the circuit closing mechanism of the track equipment.

Secondly—The additional energy necessary for the propulsion of the cars owing to the extra weight of the special apparatus carried on the car.

Thirdly—The surface leakage from box to rail over the paving under each car on the track.

Of the above-mentioned sources of power waste, the first two only need be seriously considered, as in the case of the third, the amount of energy wasted by surface leakage is so small as to be negligible.

In the case of the Lorain system as installed at Wolverhampton, the current required for the operation of the circuit closing mechanism in the track equipment, which is in this case the energy required for the excitation of the magnets, represents a power consumption of 670 watts per hour, which is equivalent, under ordinary conditions of service, to ·11 unit per car-mile.

In Wolverhampton the routes at present in operation include some rather severe gradients, and owing to the fact that a large proportion of the road surfaces in the vicinity of the routes are macadamised, the track is always very muddy and greasy in wet weather, and correspondingly dusty in dry weather. The tendency is, therefore, for the current consumption per car-mile to be rather heavy, the average during the past 12 months being 1·49 units.

Under these conditions, the author has calculated that the additional current consumption due to the weight of the Lorain equipment is approximately equal to ·13 unit per car-mile.

The *total* additional current consumption to be debited against the surface-contact system is in this case ·24 unit per car-mile, or approximately 19 per cent. in excess of what would have been required by the overhead system.

Cost of Installation.—Although perhaps not of such vital importance as the cost of operation, yet, nevertheless, the capital cost of installation must weigh heavily in considering the merits of any system, and it is obvious, therefore, that any system of electric traction which desires to enter into competition with the overhead trolley system must be capable of being installed at a cost not very much in excess of the latter.

It is very difficult, if not impossible, to give a general figure for the difference in first cost of the overhead system and the surface-contact system, owing to the fact that whilst the cost of the former is practically the same for either double or single track, the cost of the electrical equipment of the latter is obviously twice as much for double track as for single. Consequently, the amount of the extra cost of installing a surface-contact system necessarily depends upon the proportion of double to single track on the routes concerned.

Speaking generally, however, it may be taken that first-class overhead construction costs from £1,500 to £2,000 *per mile of route*, whether double or single, whereas the cost of the surface-contact system will be from £2,000 to £2,500 *per mile of single track*.

Disfigurement of Streets and Obstruction to Traffic.—One has only to compare the present appearance of St. George's Square, Liverpool, or Piccadilly, Manchester, with what it was before the introduction of electric traction to realise the great disfigurement due to the erection of poles and wires along these fine thoroughfares.

Where centre-pole construction is in use, there is, in addition to the unsightliness involved, another very serious objection—namely, the obstruction to traffic. There can be no doubt whatever that the introduction of centre-poles into a street of average width very largely reduces the accommodation for vehicular traffic, and materially adds to the congestion of the already overcrowded streets in many of our large towns.

It is claimed for the surface contact system, that it offers less impediment to the free use of the streets and side walks than any other system of electric traction in which the energy for the propulsion of the cars is collected from an external source, and the experience of the author in connection with the Wolverhampton tramways leads him to believe that this claim is justified.

During the two and a half years that the system has been in operation no complaint of any kind has been received as to any obstruction or inconvenience to traffic having been caused by the iron top-plates in the street surface, and so far as the author is aware no accident of any kind has ever been attributed to them. There is moreover no indication of any abnormal wear of the paving surrounding the studs, neither wood nor granite paving in the immediate vicinity of the metal top-plates appearing to wear any faster than at other parts of the track.

On the score of appearance it may fairly be said that the surface contact system is the least conspicuous and the least objectionable of any system of electrical traction, in fact, it is the author's experience that unless the track is abnormally clean and free from dirt, it is very difficult to distinguish the studs from the remainder of the paving.

There can be very little doubt that from the point of view of the property owner in good residential districts, the surface contact system is distinctly preferable to the overhead system, as it is much less likely to cause depreciation in the value of the property adjoining the tramway routes.

Owing to the large number of factories in the town engaged in the production of stamped steel and iron articles, a very large quantity of scrap iron of all sorts and sizes is produced and has to be carted away from the various works. This scrap iron is usually very carelessly heaped in open carts, with the result that a considerable percentage of each load is scattered in the street, and it unfortunately happens that the principal repositories for scrap iron are situated on the busiest tramway routes. As previously explained, the presence of this scrap iron constitutes the most serious difficulty the system has had to contend with.

It should be pointed out, moreover, that in Wolverhampton the track is laid to a 3 ft. 6 in. gauge, and consequently the space available between the rails, and between the side frames of the trucks, for the reception of the surface contact apparatus is comparatively limited, and the author believes that with the standard 4 ft. 8½ in. gauge many of the troubles experienced with the upkeep of the magnet and collecting skates would largely, if not entirely, disappear, and the arrangement of the track equipment at points, crossings, and other special track work, would be considerably simplified.

The conclusions arrived at in the foregoing paper may be briefly summarised as follows:—

A well designed and carefully installed surface contact system is superior to the overhead trolley system in respect of the questions of safety, reliability, disfigurement of streets, and obstruction to traffic.

The overhead system is considerably cheaper both as regards the capital cost of installation, and the annual cost of operation and maintenance.

For tramway systems where low initial cost and low annual charges are the first consideration, and especially for light railways in thinly populated districts, the overhead system is to be preferred.

In many of our larger towns, and especially at watering places and other pleasure resorts, the surface contact system has many claims for serious consideration in preference to the overhead trolley system.

Mr. J. H. Rider, chief electrical engineer of the L.C.C. tramways, in opening the discussion, asked how access was obtained under the cars, as apparently the car-shed had no pits; in his opinion, car-sheds should be all pits. The author had made an important point of the safety of the system, but he then proceeded to give long lists of partially live studs totalling 109—an almost impossible number of faults for 12 months' work with a similar overhead system. He thought Wolverhampton was altogether the wrong place to use a surface-contact system, with so much scrap iron about the streets, and as regarded the chance of stepping on live studs, he thought Providence certainly had a good deal to do with Wolverhampton's immunity from accidents. He believed that the boxes would fail through the contact pieces not falling, also that a live stud could not be earthed, as could a tramway pole. The danger of contact studs lay in the fact that no one knew they were alive until the accident happened. Contrary to the author's opinion, the overhead trolley system invariably used double insulation, and if such a system were properly designed the trolley should run anywhere without the attention of the conductor. The speaker also took exception to the additional weight of the Lorain car, and concluded by remarking that he had heard that the quick car service at Wolverhampton was possible because horses and carts had learnt from experience the advisability of keeping off the track.

Mr. Wetmore (of the Lorain Co.), on the invitation of the Chairman, stated that his company preferred to take a system with adverse conditions, as at Wolverhampton, for, having overcome the difficulties at such a place, it was comparatively easy to succeed under ideal conditions. Wolverhampton had the only surface contact tramway operating commercially in the world. Other surface contact systems had been operated, *e.g.*, those in Paris—systems in which the contacts were made with a solenoid, or depended on mercury cups—but these failed under practical conditions. They had no record of an armature failing to fall from any cause, and a driver would know if a contact had failed, as the current would be cut off there. The extra weight of the Lorain car was slightly against it, but not compared with a conduit car.

Mr. F. C. Raphael commented on the grossly exaggerated views of Manchester overhead network (which the author had thoughtfully provided for purposes of comparison with others of the Wolverhampton system). From his own experience it was usually almost impossible to distinguish trolley networks in a photograph.

Mr. J. F. C. Snell, Sunderland, thought that leakage at Wolverhampton was a very serious matter, and that trouble would result from horses slipping on the lengthy series of metal plates in the centres of the tracks. They were, however, to be congratulated if traffic avoided the tramway, because track repairs were a very serious item on most lines.

Mr. Stanley Clegg, Lincoln, mentioned that his Corporation had practically decided on adopting the "G.B." surface contact system for its tramways. In regard to cost of repairs on trolley systems, in 30 towns he had circularised it varied from £5 to £95 per mile of track, whereas Mr. Shawfield's figure was £21, and much below the average.

Mr. C. E. C. Shawfield, in replying, stated that the car-sheds

referred to in the discussion were old ones, and the newer ones were all pits, but no extra wages costs were incurred in inspection of cars, &c., as compared with the trolley car. The "live stud" danger was much exaggerated. Barefooted youngsters in Wolverhampton often reported them at the nearest car-shed, and earned coppers thereby. Contact-box failures were due mostly to short-circuits under the cars when the latter pulled up, and the conductor usually got down and felt the stud. It was, of course, impossible for the main circuit to be broken in a box, but the small leakage current was. The average leakage current in dry weather was less than $\frac{1}{100}$ ampere, in wet weather $\frac{1}{10}$ ampere, and in muddy weather 1 to 1½ amperes at crossings, per car in service, the total amount being equal to ·008 unit per car-mile over the 12 months. The time taken up in repairing or removing a box was about 15 minutes, and when minute faults occurred, as they did, in the cables, they could be detected by removing one or two boxes and testing back.

THE SPEN VALLEY TRAMCAR ACCIDENT: BOARD OF TRADE REPORT.

MAJOR DRUITT'S report has been issued respecting the collision between a tramcar and various vehicles, which occurred on May 20th, in Halifax Road, Dewsbury, on the Spen Valley Light Railway. The car in question, No. 7, belonging to the Yorkshire (Woollen District) Electric Tramways, Ltd., is a four-wheeled doubled-decked car with a top cover, fitted with the usual hand brakes, Spencer "Scotch" brake, and the Westinghouse magnetic slipper brake. The controller is of the H D2 Brush pattern. The car is also fitted with the Tidswell lifeguard. After entering, in some detail, into the character of the line, and the evidence given, the Major concludes:—

"Taking all the evidence available into consideration, I think what probably happened was that Stead let the car go too fast after leaving Oxford Road, *i.e.*, when he put the controller handle to the fourth notch of the Westinghouse brake, and just then catching sight of the wagon foul of the line at the Bath Hotel (which is only 285 yards from Oxford Road on a very steep gradient, partly 1 in 9), put back the controller handle to the seventh notch, and not getting the immediate braking effect expected, at once applied what is known as the electric "Scotch" brake, but this, when applied at the high speed which the car had then gained, has the effect of skidding the wheels for a short time, and the car does not check its speed at once, and feeding the motors in parallel with the power handle reversed and the canopy switch thrown off has a similar effect, though not so great. In each case Stead, in his anxiety to stop the car before colliding with the wagon, probably did not allow sufficient time for either brake to take effect, and after the first collision he did nothing. He says the reason for attempting nothing after that happened was that all his gear, including the spindle of the hand brake, was bent, but there is the evidence of witnesses throwing doubt on this.

"If the hand-brake was still available, Stead could have reduced the violence of the second collision very considerably, even if he could not have stopped the car, had he applied it; but it is impossible for anyone to say for certain in what condition it was, with the exception of Stead himself.

"As far as can be judged, the car was in good order at the time of the runaway, and had nothing wrong with the brakes. There is practically no doubt about this.

"I think the bad accident was caused by Stead's anxiety to prevent the first collision with the wagon at the Bath Hotel, and after that he lost his head, and could do nothing.

"As before pointed out in accident reports, a much higher standard of training is required for men who are put in charge of electrically worked brakes than for those who have to use purely mechanical brakes, because, in brakes of the first nature, the men, as a rule, do not understand how and why the brakes act, and if, in an emergency, they do not at once get the braking effect desired or expected, they at once jump to the conclusion that the Westinghouse brake has failed and begin to try the effect of another brake without giving the necessary time for the first brake to act, with the result that the car runs away. The whole affair is a matter of seconds, and it requires the greatest knowledge of, and confidence in, the mechanism employed, for a man to wait even a few seconds for the brake to take effect, while he is rapidly approaching an obstacle in his track, without thinking that something may have failed and acting on impulse in a wrong manner.

"The company should check in the strictest manner any sign of the motormen coming down the hill in question faster than the authorised speed, especially on the steep 1 in 9 gradient between Carlton Street, where there is a stop, and Albion Street, between which the speed should not exceed 4 miles an hour.

"The conduct of Oldroyd, the conductor of the runaway car, is to be highly commended. By preventing the passengers jumping off the runaway car, he undoubtedly prevented them being seriously injured and possibly being killed. He is, unfortunately, suffering severely from shock.

Belgium.—La Société des Chemins de Fer Electriques Vicinaux, of Brussels, reports a profit of £412 for the last financial year.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

13,908. "Improvements in means for producing electric arcs from alternating currents, also applicable for rectifying alternating currents." E. WEINTRAUB. June 20th. (Date applied for under Patents Act, 1901, June 20th, 1903, being date of application in United States.) (Complete.)

13,925. "Improvements in electric arc lamps." G. W. MATTHEW. June 20th.

13,927. "An improved system and apparatus for electrically operating bulkhead doors, hatches, or the like." A. P. JONES. (Long Arm System Co., United States.) June 20th.

13,933. "Improvements in or relating to storage battery separators." A. J. BOULT. (N. Dodge, United States.) June 20th. (Complete.)

13,937. "Improved system of installation of electric apparatus for traction in mines or other places containing explosive gas." E. F. J. MODESSE. June 20th

13,947. "Improved construction of electric tumbler switch." G. SMITH. June 20th.

13,952. "Apparatus operating with automatic regulation for submitting gases and vapours to the action of the electric arc." O. IMRAY. (Société Anonyme d'Etudes Electro-Chimiques.) June 20th.

13,979. "Improvements in electric lamps." E. A. CAROLAN. (General Electric Co., United States.) June 20th.

13,984. "An improvement in electric fuseboards and fuses." G. M. PINKERTON. June 20th.

14,020. "Improvements in electrostatic apparatus for measuring electrical potential differences." E. W. MARCHANT and G. W. WORRALL. June 21st. (Complete.)

14,058. "Improvements in solutions for the electro-deposition of metal." L. POTTHOFF. June 21st. (Complete.)

14,059 "Improvements in apparatus for electro-galvanising." L. POTTHOFF. June 21st. (Complete.)

14,060. "Improvements in conductors and collector devices for electric railways and tramways." A. BOLZANO. June 21st. (Complete.)

14,066. "An improved high voltage battery." L. DE GOURNAY. June 21st. (Complete.)

14,071. "Improvements in the raising and lowering of arc lamps." H. H. BERRY and E. SKINNER. June 21st.

14,087. "Improved box and lid for electric accumulators on board ships, motor cars, and the like." A. A. SMETHURST and T. H. BISHOP. June 22nd.

14,117. "Improved form of protected conductor rail for electric railways." R. O. SULLIVAN. June 22nd.

14,128. "Improved method of preliminary treatment for accumulator plates." H. LEITNER. June 22nd.

14,135. "Improvements in or relating to apparatus for supplying current to electrically propelled vehicles and the like." T. L. KOLKIN. June 22nd.

14,136. "Improvements in brush holders for electrical machines." W. H. FOOT. (Date applied for under Patents Act, 1901, June 24th, 1903, being date of application in United States.) June 22nd. (Complete.)

14,139. "Improvements in and connected with arc lamps." F. DE ZEA BERMUDEZ. June 22nd.

14,147. "Improvements in and relating to the electrolytic depositing of metals." S. O. COWPER-COLES and THE METALS CORPORATION, LTD. June 22nd.

14,148. "Improvements in vapour electric lamps." O. O. KRUH. (Date applied for under Patents Act, 1901, June 22nd, 1903, being date of application in United States.) June 22nd. (Complete.)

14,160. "Improvements in or relating to electric clocks and electro-motive apparatus therefor and for other purposes." S. PALMER. June 22nd. (Complete.)

14,163. "Improvements in movable overhead frogs or switches and section insulators for electric railways and tramways." June 22nd.

14,170. "Improvements in electrical accumulators." T. RIGG. June 23rd.

14,185. "Improvements in electric conductors for tramways worked on the conduit system." W. J. A. WATKINS. June 23rd.

14,196. "Improvements in electrodes for arc lighting." THE BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) June 23rd.

14,221. "Improvements in and relating to galvanic batteries." R. DREIBHOLZ. June 23rd. (Complete.)

14,231. "Improvements in electric sparking plugs for internal combustion motors." H. J. LA FORCE. June 23rd. (Date applied for under Patents Act, 1901, June 24th, 1903, being date of application in France.) (Complete.)

14,239. "Improvements in or relating to electric traction engines." C. DE KANDO. June 23rd. (Complete.)

14,247. "Improvements in bucket-wheel construction for elastic fluid turbines." THE WARWICK MACHINERY CO., LTD. (The General Electric Co., United States.) June 23rd.

14,250. "Improvements in dynamo-electric machines and the like." L. TORDA. June 23rd.

14,294. "An improvement connected with the 'live rails' of electric railways." T. M. LYNCH. June 25th.

14,350. "Electrically operated signalling and braking devices for railway trains." P. KRAUSE. June 25th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

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HIGH VOLTAGE SPARK ARRESTERS. J. V. Johnson. (Communicated.) 26,058. November 28th.

COUPLINGS FOR ELECTRIC CABLES. F. W. Howorth. (F. Everhart and J. Dossert, United States.) 26,174. November 30th.

TELEPHONE TRANSMITTERS. P. G. Randall. 26,248. December 1st.

APPARATUS OR MEANS FOR REGULATING OR GOVERNING THE SPEED OF ENGINES EMPLOYED IN DRIVING ELECTRIC CURRENT GENERATORS. J. Y. Johnson. (The Electrizitats-Aktien-Gesellschaft vormals W. Lahmeyer & Co., Germany.) 26,259. December 1st.

MAGNETIC ELECTRIC IGNITING DEVICES FOR INTERNAL COMBUSTION ENGINE. C. Bailly. 26,261. December 1st.

MEANS FOR EFFECTING THE REGULATION OF SYNCHRONOUS ALTERNATING OR THREE-PHASE CURRENT ELECTRIC MOTORS. J. Y. Johnson. (The Elektricitats-Aktien-Gesellschaft vormals W. Lahmeyer & Co., Germany.) 26,378. December 2nd.